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ABSTRACT

Presented is the final product of a task force commissioned by the West Virginia Department of Education (WVDE) to study mathematics education in the state and formulate recommendations for improving mathematics achievement. The Mathematics Task Force (MTF) was commissioned in April, 1979, after the WVDE formally recognized mathematics as a top priority curriculum area and after analysis of student achievement revealed a highly unsatisfactory achievement profile. The 22 people selected for the MTF represented teachers, guidance counselors, special educators, principals, mathematics supervisors, county superintendents, college mathematics educators, and the lay public. The first of the three main sections of this report discusses the data collected, the samples from whom data were collected, and the procedures used for identifying needs and the related recommendations. The next chapter contains all the recommendations formulated, grouped into 15 need areas. The final chapter is a summary and conclusion which includes a discussion of the recommendations and comments on their implementation. The document concludes with ten appendices related to the study. (MP)

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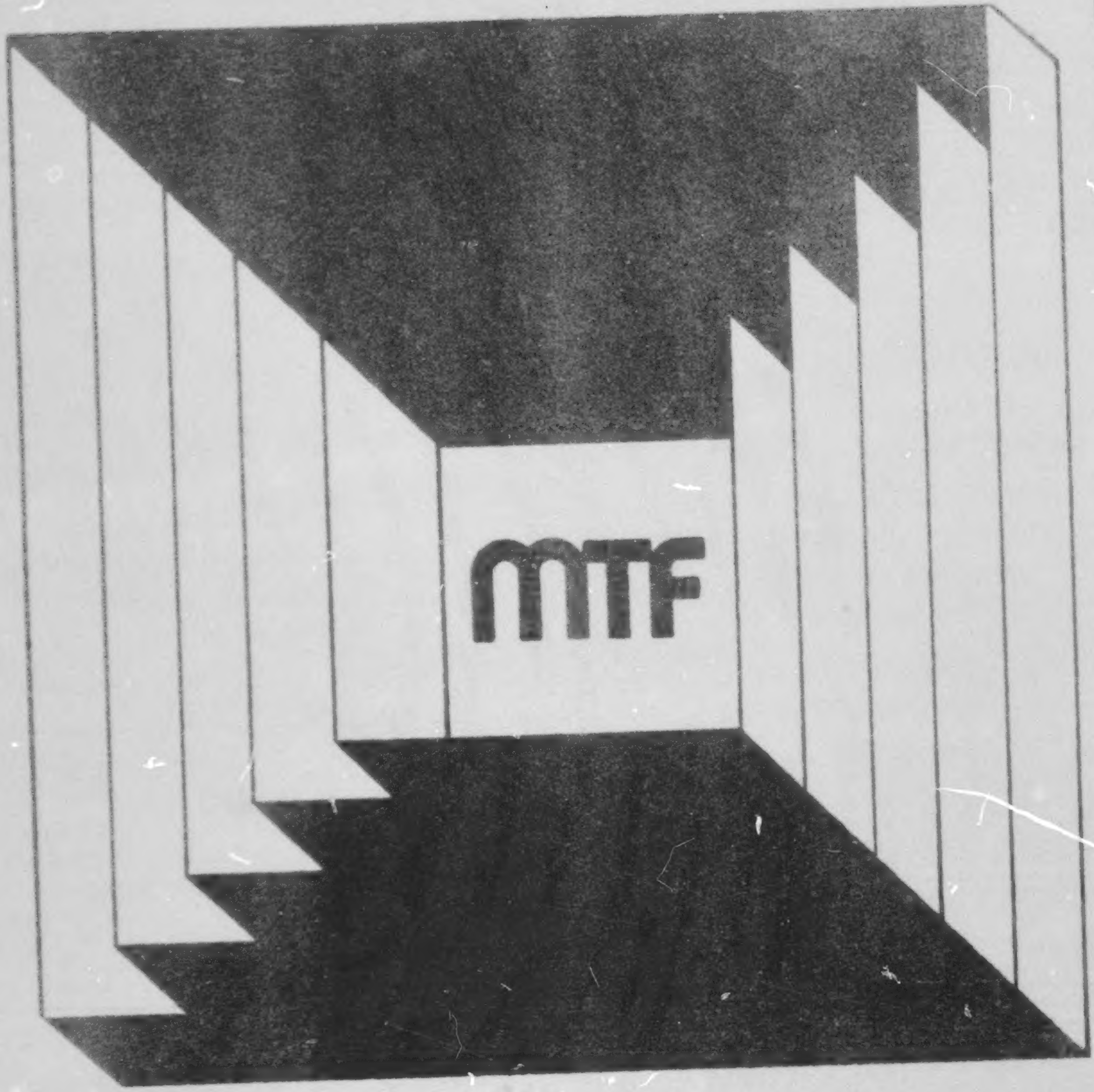

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Recommendations for Mathematics Education: Final Report of the Mathematics Task Force

U.S. DEPARTMENT OF HEALTH,
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RECOMMENDATIONS FOR MATHEMATICS EDUCATION:
FINAL REPORT OF THE
MATHEMATICS TASK FORCE

Prepared by the
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Presented to the West Virginia Department of Education, April 3, 1980

PREFACE

The Mathematics Task Force was commissioned by the West Virginia Department of Education to study mathematics education in West Virginia and formulate recommendations for improving mathematics achievement. This document is the final report of the Mathematics Task Force.

The members of the Mathematics Task Force feel extremely fortunate to have worked with the West Virginia Department of Education, mathematics educators, and laypersons across the State in order to fulfill their commission and their obligation. The number of people involved in the Task Force operation and data collection has been overwhelming. The commitment of all concerned has been truly gratifying.

The final evaluation of the success of the Mathematics Task Force will be whether the mathematics program for students in West Virginia is improved as result of implementing the recommendations in this report. The future of West Virginia may well be affected by how successfully students are provided with the necessary mathematics for both personal needs and the successful pursuit of a career in an increasingly scientific and technological society. Mathematics should be an integral part of any educational program designed to produce citizens capable of effective decision-making and problem solving.

ACKNOWLEDGEMENTS

We, the members of the Mathematics Task Force, would like to express our appreciation to the West Virginia Department of Education for the opportunity to make recommendations for improving mathematics education in the State of West Virginia. We are humble in the knowledge that it is an opportunity that has never been given to mathematics educators in West Virginia, and we hope that we have fulfilled the faith and confidence shown in us.

We sincerely appreciate the commitment shown by the West Virginia Department of Education in assisting us with this task. We particularly would like to thank Dr. Phil E. Suiter, Assistant State Superintendent, Bureau of Learning Systems, for the leadership and assistance he provided. We also wish to thank Dr. Joseph C. Basile, II, Director, Division of Instructional Learning Systems, for his assistance. The task would not have been completed without the assistance of Mr. James R. Myers, Curriculum Development Specialist, Mathematics. The data collection process for the study was an enormous task. We have Dr. John McClure, Director; Mr. Charles Duffy, Assistant Director; and Mr. John Willis, Coordinator, Division of Evaluation and Information Systems, to thank for organizing the data to make the task a reality. We are grateful for the time and efforts of these individuals.

Finally, we need most of all to thank the thousands of mathematics educators, teachers, principals, supervisors, superintendents, college personnel, and laypersons across the State of West Virginia who gave their valuable time to respond to the survey instruments. The response was tremendous, and we hope that we have justified the use of their time by the quality of this report.

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CHAPTER ONE

INTRODUCTION

The West Virginia Board of Education has formally identified mathematics as a top priority curriculum area for West Virginia's elementary and secondary schools.[a] One result of doing this has been the close monitoring of mathematics student achievement. Regrettably, a recent analysis of student achievement shows that the mathematics achievement profile is unsatisfactory. In particular, mathematics achievement scores are lower than scores in all other basic skill areas, and mathematics achievement scores show a gradual decline through the years for which comparative data are available (see Appendix A).

The top priority status given to mathematics, together with the unsatisfactory mathematics achievement profile, prompted the West Virginia Department of Education (WVDE) to develop a plan for improving mathematics education in West Virginia.[b] One component of the plan developed by the WVDE was to initiate a mathematics task force to conduct a study of mathematics education in West Virginia and, subsequently, to make recommendations to the WVDE concerning ways to improve mathematics achievement. In April 1979, a mathematics task force was commissioned. This document is the final report of the Mathematics Task Force.

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[a] Educational Goals for West Virginia. Charleston, West Virginia: West Virginia Department of Education, 1975.

[b] Annual Plan for the Improvement of Educational Achievement in West Virginia, 1978-79. Charleston, West Virginia: West Virginia Department of Education, 1978.

Makeup of the Mathematics Task Force

Twenty-two people participated on the Mathematics Task Force (MTF). These people were selected from a variety of geographical and occupational areas in order to reflect the needs and perceptions of different publics in West Virginia. Specifically, the following groups were represented on the MTF: teachers (7), guidance counselors (1), special educators (1), principals (2), mathematics supervisors (6), county superintendents (1), college mathematics educators (3), and the laypublic (1).[c] The names of the MTF members and a description of the selection procedures are included in Appendix B.

Chronology of the MTF Study

The MTF was commissioned in April 1979 and completed its work in February 1980. A chronology of the work of the MTF is in Appendix C.

Overview of the Report

Three sections follow in the balance of this report. Chapter Two, "Design of the MTF Study," describes the process used by the MTF to develop recommendations for improving mathematics education in West Virginia. Included in that chapter is a discussion of the data collected by the MTF, the samples from whom data were collected, and the procedures used for identifying needs and the related recommendations.

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[c] The number in parentheses indicates how many people from that group participated on the MTF.

The third chapter of the report contains all of the "recommendations" formulated by the MTF. The recommendations are grouped into 15 "need areas" (e.g., teacher education); and, for each need area, an overview of the recommendations and a summary of the relevant data collected by the MTF are provided. The final chapter of the report contains a "Summary and Conclusion" which includes a discussion of the recommendations and comments on their implementation.

The number of data collection instruments used in this study is too large and the quantity of data is too great to include these materials in the same document as the MTF recommendations. Therefore, sample data collection instruments and some data are included in this document (see Appendices D and E). All instruments and data are included in separate reports: (a) Data Collection Instruments: Mathematics Task Force and (b) Data and Findings: Mathematics Task Force.

CHAPTER TWO

DESIGN OF THE MATHEMATICS TASK FORCE (MTF) STUDY

Figure 1 shows the process used by the MTF to develop recommendations for improving mathematics education in West Virginia and the five major categories of activities. The names given to the major categories are listed below. The remainder of this chapter details the activities within each major category.

1. Identification of Characteristics of Successful Mathematics Programs
2. Data Collection
3. Tabulation of Data
4. Data Analysis and Identification of Needs
5. Formulation of Recommendations

Identification of Characteristics of Successful Mathematics Programs

The initial task of the MTF was to identify characteristics of successful mathematics programs at the elementary, secondary, and higher education levels and to identify other characteristics of an educational system that influence mathematics education. An initial list of program characterist was generated based on the knowledge and experience of the MTF members. Then, major mathematics education research and conference reports were examined to identify other program characteristics that affect mathematics education. Among the research and conference reports examined by the MTF were the following:

(1) Begle, E.G. Critical Variables in Mathematics Education: Findings From a Survey of the Empirical Literature. Washington, D.C.: Mathematical Association of America & the National Council of Teachers of Mathematics, 1979.

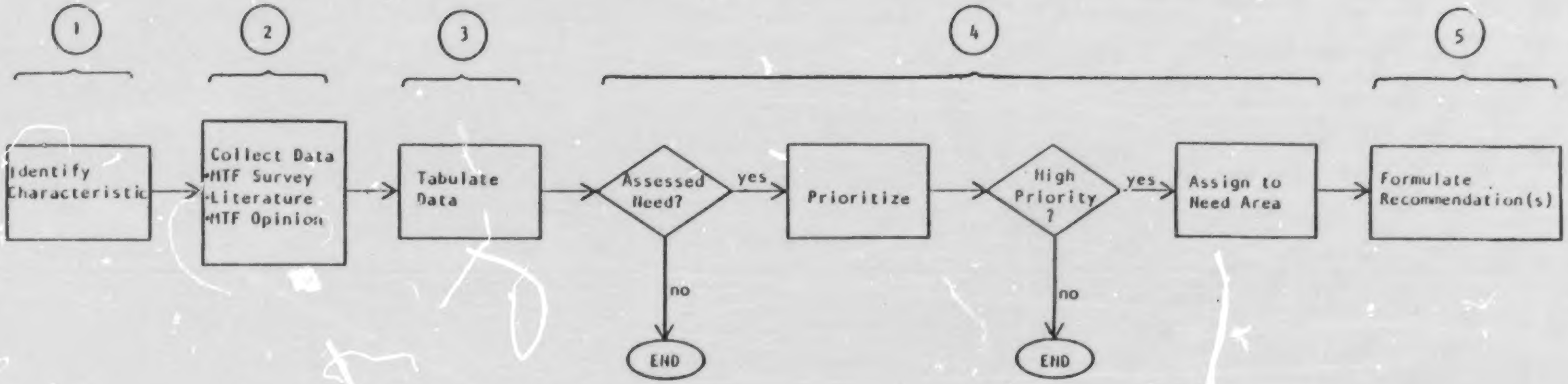
1
2
3
4
5
Identify Characteristic
Collect Data
-MTF Survey
-Literature
-MTF Opinion
Tabulate Data
Assessed Need?
yes
no
END
Prioritize
High Priority ?
yes
no
END
Assign to Need Area
Formulate Recommendation(s)

Figure 1: Process used by the Mathematics Task Force to make recommendations

(2) Suydam, M.N. and Osborne, A. The Status of Pre-college Science, Mathematics, and Social Science Education: 1955-1975, Volume II: Mathematics Education. The Ohio State University: The ERIC Science, Mathematics, and Environmental Education Clearinghouse, 1977.

(3) Conference Board of the Mathematical Sciences and the National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics K-12. Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

(4) Springer, G. (Director), Report of the Conference on the K-12 Mathematics Curriculum. Snowmass, Colorado: National Science Foundation, 1973.

(5) Wilson, J.W. & Carry, L.R. (Eds.), Studies in Mathematics (Volume XIX): Reviews of Recent Research in Mathematics Education. Stanford University: School Mathematics Study Group, 1960.

The program characteristics selected by the MTF were classified in five categories:

1. Administration and Organization - personnel, finance, facilities, etc.
2. Curriculum - content, instructional material, etc.
3. Instruction - teaching methods, pupil evaluation, etc.
4. Professional Development - preservice education and continuing education.
5. Others - community, West Virginia Department of Education, etc.

All of the program characteristics identified by the MTF are included in Appendix F.

Data Collection

Data Collection Instruments. A decision was made for each program characteristic concerning how and from whom data related to that characteristic would be collected. Six groups were identified from whom data would be collected, and ten data collection instruments were developed. Appendix G shows the names of the instruments, the group(s) given each instrument, and the data collected for each program characteristic. Sample instruments are included in Appendix D, and all instruments are included in the document Data Collection Instruments: Mathematics Task Force. Below is a summary of the purpose of each instrument.

1. Opinionnaires were designed to gather information concerning issues in mathematics education, curricular emphases, and professional development practices.

2. A Program Description instrument was designed to gather teachers' perceptions of the mathematics program in their school and county. Some of the topics included were attitudes, physical facilities, instructional materials, and teaching methods.

3. The Instructional Practices instrument was designed to assess the extent to which various instructional aids, activities, and teaching strategies are used by teachers.

4-5. Preservice and Inservice Questionnaires were developed to obtain opinions concerning the amount of emphasis that should be given to various mathematics content and methods topics in future preservice education programs and future continuing education programs.

6. Background Information was obtained from all teachers and counselors in the study. Information such as the number of graduate hours in mathematics education and the number of hours in mathematics education inservice programs was collected.

7. A School Mathematics Program Survey was completed by principals for the purpose of obtaining quantitative data at the school level in areas such as enrollment, organization patterns, supervision, evaluation, and special programs. Three levels were developed: elementary school, middle/junior high school, and senior high school.

8. The Superintendents' Survey was designed to obtain data at the county level in areas such as inservice education and supervision.

9. The College Survey was developed to collect data on preservice education and continuing education programs.

10. Open-ended Questionnaires consisted of three questions: (1) In your opinion, what are the three greatest strengths of the mathematics program in your school? (2) In your opinion, what are the three greatest needs of the mathematics program in your school? (3) What specific recommendations would you make to improve the mathematics program in West Virginia?

A large number of items were developed for four of the instruments: Opinionnaires, Program Description, Preservice Questionnaire, and Inservice Questionnaire. To reduce the amount of time needed to complete these instruments, half of the Opinionnaire and Program Description items were completed by half of the respondents, and the other half of the items were completed by the remaining respondents. Similarly, half of the respondents completed the Preservice Questionnaire, and half of the respondents completed the Inservice Questionnaire.

All instruments were piloted prior to being used in the study. The purposes for piloting the instruments were to determine the clarity of the items, to determine the feasibility of collecting certain data, and to assess the amount of time needed to complete the instruments. Revisions in the instruments were made as a result of the pilot, and the instruments used in the study were finalized.

Most data collected for each program characteristic were obtained from the survey instruments. However, for each characteristic, two additional data sources were used: (a) literature and research related to mathematics education and (b) the opinions of the members of the MTF. Therefore, for each program characteristic there were three possible sources of data: (1) MTF survey; (2) literature and research; and (3) MTF opinion.

In addition to the data related to program characteristics, two types of mathematics achievement data were collected: (a) State-County Testing Program (SCTP) and (b) ACT-Mathematics. A summary of these data is included in Appendix A. A detailed discussion of the achievement data from the SCTP is in the document Mathematics Achievement in West Virginia, 1978-79.

Samples. The MTF study was designed so that many types of data would be collected from a variety of groups throughout West Virginia. This was done to ensure the validity of the recommendations. A further effort made to ensure the development of valid recommendations was the collection of data from as large a number of representatives of each group as possible. Since data were to be collected from a large number of people, a mail survey was identified as the primary means for collecting data. The survey instruments were mailed in May 1979 and returned in June 1979. Follow-up phone calls were made to ensure a satisfactory return.

The following describes the samples from whom data were collected and the percent of return for the survey instruments.

1. Middle, Junior High, and Senior High School Principals and Teachers. All middle, junior high, and senior high schools included in the State listing were surveyed. A packet was sent to each principal with instructions for the principal to complete a questionnaire about the school. The principal was also asked to distribute survey instruments to all mathematics teachers, all special education teachers, all special program mathematics teachers (e.g., Title I), and all guidance counselors. The number of these individuals in each school was obtained from the West Virginia Education Directory, 1978-79. Table 1 shows the return of this sample.

Table 1

Return for Middle School, Junior High School, and Senior High School Teachers and Principals[a]

	Middle/JHS Teachers	Senior High Teachers	Total Teachers	Middle/JHS Principals	Senior High Principals	Total Principals
Number Surveyed	1078	1107	2185	173	185	358
Number Returned	721	790	1511	158	151	309
% Returned	67	71	69	91	82	86

2. Elementary School Principals and Teachers. A sample of 100 schools was randomly selected from the State listing of schools classified as elementary. Using the West Virginia Education Directory, 1978-79, the number of teachers in each school was identified. Again, a package was sent to each principal with instructions for the principal to complete a questionnaire about the school. The principal was also asked to distribute survey instruments to all teachers teaching mathematics, all special education teachers, all special program mathematics teachers, and all guidance counselors. Table 2 shows the return for this sample. The random sample of elementary schools was supplemented with a set of schools whose sixth grade mean total mathematics scores were expected to be substantially higher or lower than other schools with third grade scores similar to theirs.

---

[a] Although data were collected from special program teachers, special education teachers, and guidance counselors, only data for regular classroom teachers were analyzed due to time limitations.

Table 2

Return for Elementary Teachers and Principals[a]

	Teachers	Principals
Number Surveyed	1095	100
Number Returned	821	78
% Returned	75	78

3. Mathematics Supervisors. All mathematics supervisors in West Virginia were sent survey instruments. The names of these persons were obtained from the Curriculum Development Specialist, Mathematics for the State Department of Education. A total of 13 supervisors were surveyed, and all surveys were returned.

4. Superintendents. All 55 county superintendents were sent survey instruments. Responses were received from 40 counties for a return percentage of 73.

5. College Professors. Survey instruments were sent to mathematics educators at all 10 four-year colleges and universities under the supervision of the West Virginia Board of Regents. College surveys were also sent to nine privately controlled colleges and four two-year colleges listed in the West Virginia Education Directory, 1978-79. A total of 135 professors were surveyed, and 43 responses were received for a return percentage of 32.

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[a] Although data were collected from special program teachers, special education teachers, and guidance counselors, only data for regular classroom teachers were analyzed due to time limitations.

6. Laypersons. Sixty-seven members of the West Virginia Congress of Parents and Teachers were surveyed at their annual state conference at Jackson's Mill.

Since the charge of the MTF was to make recommendations concerning the improvement of mathematics achievement, the data were analyzed for relationships between student achievement and the program characteristics identified by the MTF (see Appendix F). The Division of Evaluation and Information Systems, together with the MTF, developed a process for classifying schools with respect to mathematics achievement. The classification of schools was based on eight achievement areas:

1. low-achievement/low-gain;
2. low-achievement/high-gain;
3. average-achievement/low-gain;
4. average-achievement/high-gain;
5. high-achievement/low-gain;
6. high-achievement/high-gain;
7. low-gain; and
8. high-gain.

At each of the three grade-level-areas used by the MTF (i.e., elementary, middle/junior high, senior high), schools meeting the criteria for the achievement areas were identified. Since all middle, junior, and senior high schools in West Virginia were included in the MTF survey, data were already available from all schools identified for the achievement areas at these grade levels. Since, at the elementary level, a sample of schools was initially selected, and since all schools categorized in the eight achievement areas were not selected in that sample, it was necessary to collect principal and teacher data from an additional 77 elementary school principals and 935 elementary school teachers.

A discussion of the rationale and process used for categorizing schools with respect to mathematics achievement is included in Appendix H. Also included in that appendix is a summary of the number of schools and teachers categorized in each achievement area.

Tabulation of Data

There were two steps in the process used for tabulating data. The first step was to complete the MTF Survey Summary Forms. For most program characteristics several types of data (e.g., Opinionnaire, Program Description, etc.) were collected from a variety of groups (e.g., teachers, superintendents, laypersons, etc.). Each MTF Survey Summary Form contains the data for all of the groups that responded to one particular survey item. For example, for the opinionnaire item, "The WVDE should increase the number of mathematics credits required for high school graduation," responses were received from six groups (middle/junior high school teachers, high school teachers, superintendents, supervisors, college mathematics educators, and laypersons). A MTF Survey Summary Form for this particular item shows the response summaries for all six groups. Thus, a separate MTF Survey Summary Form was completed for each survey item.

The second step in the process of tabulating data was to record all data for each program characteristic on a Findings-Assessed Need Form. Each Findings-Assessed Need Form contains a compilation of the data from the MTF Survey Summary Forms, a note concerning a literature reference, and/or a statement of opinion from the MTF. Thus, for each program characteristic, there is one Findings-Assessed Need Form. A sample MTF Survey Summary Form and a sample Findings-Assessed Need Form are in Appendix I. All MTF Survey Summary Forms and Findings-Assessed Need Forms are in the document Data and Findings: Mathematics Task Force.

Finally, it is important to note how data were compiled from the MTF survey instruments. Six of the 10 survey instruments were designed using a multiple-choice response format. For these items, data were compiled by the percent of respondents selecting each response category. The other four data collection instruments were designed using an open-ended response format. For these items, data were compiled using a frequency table converted to percents. For the Open-ended Questionnaire, the variety of responses was so great that it was necessary to categorize responses. A team of mathematics educators identified categories, and a reliable process for categorizing responses was developed and used.

Data Analysis and Identification of Needs

Assessed Needs. Figure 1 (see page 5) shows the next step in the process used by the MTF was to analyze all data for each program characteristic and determine whether an assessed need exists relative to that characteristic. An assessed need was said to exist if a "discrepancy" in the findings was found. A "discrepancy" was defined as a difference between "what is" the current practice relative to a program characteristic and "what should be" the current practice. "What is" the current practice and "what should be" the current practice were determined from data from the MTF survey (e.g., an Opinionnaire item versus data on an Instructional Practice item), literature, and/or opinions of the MTF. An assessed need was also said to exist if a relationship between a program characteristic and student achievement was found in the MTF data. However, the MTF was aware that the achievement data collected for this study was correlational and, as a result, was quite careful not to infer a cause-and-effect relationship when establishing an assessed need.

An assessed need was said not to exist if data were "inconclusive" or "conflicting." Data were "inconclusive" if a clear position relative to a program characteristic could not be identified. For example, there was no strong opinion from any group on whether the State-County Testing Program should be extended to seniors. Data were "conflicting" if the members of the MTF had differing opinions relative to a program characteristic, if survey data were "split," and if no literature was available to support a position. For example, there were differing opinions in the survey, among the MTF, and in the literature whether the mathematics program should be departmentalized above grade three. Therefore, the data were "conflicting," and an assessed need was said not to exist for this program characteristic.

Prioritized Assessed Needs. Each program characteristic for which there was an assessed need was categorized as "high priority" or "low priority." The decision on high versus low priority was based on the strength of the findings and the importance of the program characteristic with respect to its potential to affect student achievement.

Need Areas. The MTF felt that the five categories into which the program characteristics were placed at the beginning of the study (see page 6) were too global for the purpose of communicating the particular needs associated with the "high priority" program characteristics. Therefore, the MTF recategorized the "high priority" program characteristics into 15 need areas. The names of these need areas are listed in alphabetical order on the following page.

1. adolescent education
2. affective domain
3. basic skills in mathematics
4. continuing education
5. curriculum development and evaluation
6. instructional materials
7. instructional practices
8. instructional time
9. mathematics teachers
10. organizational network
11. organizing for instruction
12. priority
13. programs for high-ability students
14. remediation programs
15. teacher education

Formulation of Recommendations

The final step in the work of the MTF was to formulate recommendations. For each "need area" two types of information were used as a basis from which recommendations were made. The first was a "data synthesis" which contains a summary of data for the program characteristics categorized in each need area. The second was a "need statement" which summarized the needs reflected by the program characteristics included in the need area. All data syntheses and need statements are in the next chapter of this report.

All program characteristics in each need area were transformed into MTF recommendations. In some instances, one program characteristic was transformed into one recommendation. However, in many instances, several program characteristics were transformed into one recommendation. In some need areas, the MTF made recommendations that did not follow directly from any program characteristic but, in the opinion of the MTF, have potential for improving mathematics education in West Virginia.

Finally, Appendix J contains a list of each program characteristic identified by the MTF at the initial meeting of the Task Force and a note describing the final status of that characteristic.

CHAPTER THREE

RECOMMENDATIONS

This chapter contains all of the recommendations of the Mathematics Task Force. The recommendations are grouped into the 15 need areas listed on page 16. For each need area, an "overview" of the recommendations is provided together with a "need statement," a "data synthesis," and a list of the "primary data sources."

The need areas are ordered alphabetically in this chapter. Also, within each need area the order of the recommendations does not reflect priority.

NEED AREA ADOLESCENT EDUCATION

OVERVIEW

Mathematics achievement scores at the 9th and 11th grades show the greatest need for improvement of any grade level or subject area tested in West Virginia.

At present, only one mathematics course is required by the State during the last four years of high school. This, in itself, may be a source of the low achievement in secondary school. mathematics. The MTF found substantial data to indicate the need for increased mathematics requirements for graduation.

Since many of the mathematics courses in the secondary school are electives, the quality and quantity of those electives influence the effectiveness of the secondary school mathematics program. Considerable work must be done to keep enrollments in mathematics courses as high as possible.

The recommendations in this area are aimed toward increasing the number of mathematics credits required for graduation, the quality and quantity of course offerings in secondary school mathematics, and student enrollment in mathematics courses.

NEED STATEMENT

There is a need to establish mathematics programs in high schools that will meet the needs and interests of all students.

DATA SYNTHESIS

Mathematics achievement at the 11th grade is the lowest of any academic area tested and is the lowest of all grade levels tested (3, 6, 9, and 11). Also, mathematics scores on the ACT are further below the national mean than any other subject area tested (see Appendix A).

Part of the problem in mathematics achievement at this level may lie in the number of mathematics credits (one) required for graduation in West Virginia. A large majority of mathematics educators across West Virginia agree that the graduation requirements in mathematics should be increased (82% middle/junior high school teachers, 91% senior high school teachers, 88% superintendents, 92% supervisors, 86% college people, and 73% laypersons). Of the 44 superintendents responding, 16 counties require 1 math credit, 26 require 2 credits, and 2 require 3 credits. Of the senior high schools responding, 21% require 1 math credit, 71% require 2 credits, and 8% require 3 credits. Also, high-gain schools require more credits (10%-1 credit, 76%-2 credits, 15%-3 credits) than do low-gain schools (46%-1 credit, 54%-2 credits, 0%-3 credits). In a study by the National Association of Secondary School Principals concerning achievement and the number of mathematics credits required for graduation, it was found those schools encouraging 3 credits of mathematics have higher achievement scores.

Another factor that may affect mathematics achievement at the adolescent education level is the quantity and quality of mathematics course offerings. The Carnegie Commission on Higher Education recommends, "High school students should be encouraged to study mathematics sequentially throughout secondary school in order to keep options open to college programs, jobs, and careers requiring background in mathematics" (Carnegie Commission on Higher Education, 1973). More than 86% of all respondents agree that high schools should offer a sufficient number of courses for noncollege-bound students so that they may successfully complete 4 years of mathematics. The large majority of respondents (86% middle/junior high school teachers, 89% senior high school teachers, 80% superintendents, 100% supervisors, 88% college persons, and 63% laypersons) felt that 5 units of mathematics should be offered for the college-bound students. (see recommendations #2 and #3)

The MTF feels that the development of program objectives for mathematics courses at the adolescent education level is important. (see recommendation #4)

Finally, data across the country show that fewer females than males pursue study of academic mathematics. In the opinion of the MTF, the adolescent education level is a critical time to examine the efforts that are made to encourage all students, particularly females, to enroll in academic mathematics courses. (see recommendations #5 and #6)

PRIMARY DATA SOURCES

1. Carnegie Commission in Higher Education. Continuity and Discontinuity, Higher Education and the Schools, New York: McGraw-Hill Company, 1973.
2. MTF characteristics: 5.8S, 9.2T, 12.1.
3. MTF opinion.
4. Achievement data.

NEED AREA: ADOLESCENT EDUCATION

NEED STATEMENT: THERE IS A NEED TO ESTABLISH MATHEMATICS PROGRAMS IN HIGH SCHOOLS THAT WILL MEET THE NEEDS AND INTERESTS OF ALL STUDENTS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER	PUBLIC/PARENT
1. Require at least three units of mathematics for high school graduation.	1. Require at least three units of mathematics for high school graduation.	1. Require at least three units of mathematics for high school graduation.		
2. Require schools to offer at least four units of "general" mathematics such as consumer mathematics, general mathematics, vocational mathematics, practical mathematics, basic skills mathematics, and shop mathematics.	2. Develop at least four units of "general" mathematics such as consumer mathematics, general mathematics, computer mathematics, vocational mathematics, practical mathematics, basic skills mathematics, and shop mathematics.	2. Offer at least four units of "general" mathematics such as consumer mathematics, general mathematics, computer mathematics, vocational mathematics, practical mathematics, basic skills mathematics, and shop mathematics.		
3. Require schools to offer at least five units of "academic" mathematics such as algebra, geometry, trigonometry, pre-calculus, computer science, and probability & statistics.	3. Develop at least five units of "academic" mathematics such as algebra, geometry, trigonometry, pre-calculus, computer science, and probability & statistics.	3. Offer at least five units of "academic" mathematics such as algebra, geometry, trigonometry, pre-calculus, computer science, and probability & statistics.		
4. Develop curriculum guides for mathematics courses, grades 9-12, (see Curriculum Development and Evaluation recommendation #1, p. 43).	4. Develop program objective for mathematics courses in grades 9-12 modeled after those developed by the West Virginia Department of Education.	4. Adopt the county mathematics program objectives.	4. Implement the county mathematics program objectives.	
		5. Urge all school personnel, particularly guidance counselors, to encourage students to enroll in mathematics courses.	5. Encourage students to enroll in mathematics courses.	5. Encourage children to enroll in mathematics courses.
		6. Urge all school personnel, particularly guidance counselors, to encourage females to enroll in mathematics courses and to consider career opportunities in mathematics-related fields.	6. Encourage capable females to enroll in mathematics courses and to consider career opportunities in mathematics-related fields.	

NEED AREA AFFECTIVE DOMAIN

OVERVIEW

The affective domain in mathematics refers to those attitudes students, teachers, and the public hold toward the teaching and learning of mathematics. These attitudes are fundamental to the successful teaching and learning of mathematics and to the decisions students make concerning career choices.

Considerable attention is being given to the concept of "math anxiety" and how it affects student achievement in mathematics. Another factor in the affective domain that affects student achievement is students' self-images in mathematics.

The entire affective area needs more attention in mathematics education. The recommendations in this section identify ways elements from the affective domain can and should be included in mathematics education.

NEED STATEMENT

There is a need to consider the affective domain in all programmatic efforts in mathematics.

DATA SYNTHESIS

The National Advisory Committee on Mathematics Education (NACOME, 1975) made the following recommendations concerning the affective domain: (see recommendations #1 and #2)

(a) that the affective as well as cognitive domains in mathematics should be the subject of constant and programmatic attention;

(b) that attempts to create more appropriate and sensitive instruments for assessing the affective domain should be mounted;

(c) that the items or scales referred to in (b) above then be included in national and regional assessments and in all major program evaluations; and

(d) that preservice and inservice programs, both general and those related to specific projects, should formally embody objectives in the affective domain and program elements to achieve them.

The MTF study found support for two items related to the affective domain. First, teachers should help students develop positive self-images with respect to mathematics (30% and 50% of teachers in middle/junior high schools and high schools, respectively, believe their students do not have positive self-images with respect to mathematics). Second, teachers should place a minimum amount of stress on students (approximately 20% of all teachers believe their schools place too much stress on students in mathematics). (see recommendations #3 and #4)

PRIMARY DATA SOURCES

1. Conference Board of the Mathematical Sciences and the National Advisory Committee on Mathematics Education (NACOME). Overview and Analysis of School Mathematics K-12. Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

2. MTF characteristics: 9.4T, 9.5T.

NEED AREA: AFFECTIVE DOMAIN

NEED STATEMENT: THERE IS A NEED TO CONSIDER THE AFFECTIVE DOMAIN IN ALL PROGRAMMATIC EFFORTS IN MATHEMATICS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER	PUBLIC/PARENT
1. Include objectives in the affective domain in all mathematics program development efforts (e.g., curriculum guides)	1. Identify and evaluate objectives in the affective domain in all mathematics programs (e.g., Title I, Title IV-C), and in all mathematics continuing education programs.	1. Assist teachers to identify and assess objectives in the affective domain related to mathematics.	1. Identify and assess objectives in the affective domain related to mathematics as part of pupil evaluation.	
2. Develop continuing education packets concerned with techniques for identifying and assessing objectives in the affective domain related to mathematics.	2. Provide continuing education for teachers concerned with techniques for identifying and assessing objectives in the affective domain related to mathematics.			
		3. Assist teachers and counselors to identify strategies for decreasing mathematics anxiety in students.	3. Implement strategies for reducing mathematics anxiety in students.	3. Exhibit a positive attitude toward the learning of mathematics.
			4. Implement instructional practices and behaviors to improve students' self-images with respect to the learning of mathematics.	

NEED AREA BASIC SKILLS IN MATHEMATICS

OVERVIEW

Mathematics educators and the laypublic agree that the "basic skills" must be taught in mathematics. However, a problem arises in defining the "basic skills" in mathematics.

The MTF supports a definition of basic skills that includes the following areas: number concepts, computational skills, problem solving, applying mathematics to everyday situations, geometry, measurement (e.g., metric system), probability and statistics, estimation and approximation, computer literacy (e.g., calculators), and the affective domain.

The following recommendations call for the adoption of a definition of "basic skills" in mathematics and suggest ways in which that definition should be utilized and disseminated.

NEED STATEMENT

There is a need to develop a definition of basic skills in mathematics and to establish a process so all mathematics programs reflect this definition.

DATA SYNTHESIS

Mathematics supervisors, college-level mathematics educators, and professional mathematics education organizations have for many years urged teachers to expand their goals for teaching mathematics beyond the development of computational ability alone. However, in a review of three national surveys concerned with mathematics teaching (Fey, 1969), it was concluded that, although most textbook publishers have followed the recommendations of the groups identified above, a large majority of teachers in mathematics in grades K through 8 believe that their sole responsibility in mathematics teaching is to develop student facility in arithmetic computation (p. 14).

While the survey findings alone are alarming, there is recent evidence that shows that a computational-skills-focus is detrimental to student achievement in many areas most people, including teachers, consider to be important. This evidence can be found in the second national assessment of mathematics skills conducted by the National Assessment of Educational Progress (NAEP). For example, a recent interpretation of the NAEP findings (Wilson, 1979) suggests that the "back-to-basics" mathematics instruction of the 1970's does not assure that students will develop satisfactory mathematical problem solving abilities.

Data from the MTF study also support the need for an expanded definition of basic skills in mathematics:

- Most agree that there should be an increased emphasis on problem solving (approximately 90% of all respondents).
- Most agree that there should be geometry experiences in the elementary school program (56% of the elementary, 55% of the middle/junior high, and 59% of the high school teachers; 73% of the superintendents; 84% of the college people; and 83% of the supervisors agree).

- There are differences of opinions whether experiences from probability and statistics should be included in the K-8 program (less than 50% of teachers and superintendents want more emphasis and 75% of supervisors and college people want more emphasis).

- There are differences of opinions whether graphing should be given more emphasis (approximately 50% of all teachers and 33% of the laypersons want more emphasis whereas 75% of the superintendents, 92% of the supervisors, and 81% of of the college people want more emphasis).

- Most people agree that measurement should be given more emphasis (61%, 71%, and 65% of the elementary, middle/junior high, and high school teachers, respectively, and 100% of the supervisors, 90% of the superintendents, 61% of the college people, and 75% of the laypublic).

- Most teachers agree that applications of mathematics should be stressed (60% of the elementary teachers and 80% of the middle/junior high and high school teachers).

- Experiences with life skills involving mathematics are not frequently provided (approximately 30% of the teachers report daily or weekly use, 65% of high school teachers teach life skills in "general" classes only, and laypersons and supervisors identified basic life skills as the 1st or 2nd need area in mathematics).

The data from the MTF study is similar to that found in the three national surveys summarized by Fey. Regrettably, a recent analysis of student achievement in West Virginia (Myers, 1979) shows that student achievement patterns in noncomputational strands (e.g., problem solving) are also similar to those found by the NAEP.

PRIMARY DATA SOURCES

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1. National Council of Supervisors of Mathematics and National Council of Teachers of Mathematics. Position Papers on Basic Skills, Arithmetic Teacher, 25 (1), 1977, pp. 18-22.

2. Fey, J.T. Mathematics Teaching Today: Perspectives from Three National Surveys, Arithmetic Teacher, 27 (2), 1979, pp. 10-14.

3. Wilson, J. An interpretation of NAEP findings. Included in Education Daily, 12 (178), September 14, 1979, p.1.

4. NAEP Reports
   (a) Changes in Mathematical Achievement, 1973-78. Report 09-MA-01.
   (b) Mathematical Knowledge and Skills, Report 09-MA-02.
   (c) Mathematical Applications, Report 09-MA-03.

5. Myers, J. Mathematics Achievement in West Virginia, 1978-79. Charleston, West Virginia: West Virginia Department of Education, 1979.

6. MTF characteristics: 4.1T, 4.2T, 4.3T, 4.4T, 4.6T, 4.8T, 4.9T, 4.10T, 5.1C, 5.1S, 5.2C, 5.2S, 5.9S, 6.5T, 8.2T.

NEED AREA: BASIC SKILLS IN MATHEMATICS

NEED STATEMENT: THERE IS A NEED TO DEVELOP A DEFINITION OF BASIC SKILLS IN MATHEMATICS AND TO ESTABLISH A PROCESS SO ALL MATHEMATICS PROGRAMS REFLECT THIS DEFINITION.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop a definition of Basic Skills in Mathematics that includes the following areas: number concepts, computational skills, problem solving, applying mathematics to everyday situations, geometry, measurement (e.g., metric system), probability and statistics, estimation and approximation, computer literacy (e.g., calculators), and the affective domain.	1. Adopt the definition of Basic Skills in Mathematics developed by the West Virginia Department of Education.	1. Establish a definition of Basic Skills in Mathematics that includes the following areas: number concepts, computational skills, problem solving, applying mathematics to everyday situations, geometry, measurement, probability and statistics, estimation and approximation, computer literacy, and the affective domain.	1. Base all mathematics instructional programs on the WVDE definition of Basic Skills in Mathematics.
1.1 Recommend that the State Board of Education adopt this definition.	1.1 Recommend that the County Board of Education adopt this definition.	1.1 Base all curriculum guides on this definition.	
1.2 Base all K-8 mathematics programs including special education mathematics programs on this definition.	1.2 Base all K-8 mathematics programs, including special education mathematics programs, on this definition.	1.2 Base all mathematics programs, including special education, vocational, etc., on this definition.	
1.3 Consider this definition when developing program objectives for all mathematics classes in grades 9-12.	1.3 Consider this definition when developing program objectives for all mathematics classes in grades 9-12.		
1.4 Develop continuing education packets for the components of this definition and provide trainers to implement these packets.	1.4 Utilize the West Virginia Department of Education packets as models in continuing education programs.		
2. Revise the Standards for the Approval of Teacher Education Programs in West Virginia to reflect the West Virginia Department of Education's definition of Basic Skills in Mathematics.			

NEED AREA CONTINUING EDUCATION

OVERVIEW

Although experience teaching mathematics is necessary for developing effective instructional strategies, experience alone is inadequate to develop and maintain the competencies needed for the effective teaching of mathematics. The rapidly growing quantity of knowledge and material related to the teaching of mathematics requires that all teachers of mathematics in grades K through 12 have frequent continuing education experiences related to mathematics education.

One of the major recommendations in this section is concerned with minimum annual continuing education requirements for all teachers of mathematics in grades K through 12. Other recommendations are concerned with the types of continuing education experiences teachers should have available to them. Two recommendations focus on factors at the State level which affect continuing education.

It is important to note that recommendations related to continuing education are found in other need areas in this report. The recommendations related to continuing education included in other sections are very specific to the need area in which they are included, while the recommendations in this section address the concept of continuing education in general.

Finally, it is necessary to define continuing education as it is used in this report. Continuing education refers to the professional development experiences obtained by a teacher. The present Systematics Program of Continuing Education for Public School Personnel in West Virginia involves three days of experiences planned by a council of educators and based on a needs assessment. These three days of continuing education are referred to in this report as the Systematic Program of Continuing Education. Therefore, the Systematic Program of Continuing Education is a subset of all the continuing education experiences a teacher can obtain. It is not all of the continuing education one can obtain.

NEED STATEMENT

All teachers of mathematics need to participate in a variety of continuing education experiences directly related to the teaching of mathematics.

DATA SYNTHESIS

The low turnover rate of teachers in recent years has shifted the attention of many from preservice education and toward continuing education. Since mathematics is the number one area of need according to achievement in West Virginia, it is essential that continuing education experiences be available to all teachers of mathematics and that these experiences be matched to the needs of West Virginia teachers. The MTF study identified many topics that need more emphasis in continuing education programs. (see recommendation #8 and the attached table)

In addition to the topics shown on the attached table, the MTF study found the following:

(a) Professional mathematics education journals and other publications are not readily available to all West Virginia teachers (not readily available for 73%, 68%, and 76% of the elementary, middle/junior high, and senior high school teachers, respectively). (see recommendation #5)

(b) Many teachers of mathematics do not have the opportunity to participate in meetings of the West Virginia Council of Teachers of Mathematics, the National Council of Teachers of Mathematics, and other meetings related to the teaching of mathematics (45%, 49%, and 40% of elementary, middle/junior high, and high school teachers, respectively, do not feel that provisions are made for them to attend mathematics education meetings). (see recommendation #3)

(c) Many teachers do not have continuing education experiences available related to the teaching and learning of mathematics (12% of all counties had no mathematics education inservice programs during the 1978-79 year). (see recommendation #1)

(d) Most teachers do not participate in mathematics education continuing education experiences (75%, 51%, and 46% of the elementary, middle/junior high, and high school teachers, respectively, had no hours of inservice specifically related to teaching mathematics during the 1978-79 school year). (see recommendation #1)

(e) Most teachers do not pursue graduate study in mathematics or mathematics education (71% of the elementary, 51% of the middle/junior high, and 35% of the high school teachers have no graduate mathematics content course and 72% of the elementary, 63% of the middle/junior high, and 59% of the high school teachers have no graduate mathematics education courses). Further, the MTF raised the question of availability of graduate study to all teachers. (see recommendation #2)

(f) Many teachers (40% of the elementary, 35% of the middle/junior high, and 34% of the high school teachers) have not had a mathematics content or a mathematics methods course within the past five years. (see recommendation #2)

(g) Most teachers (73% of the elementary, 85% of the middle/junior high, and 81% of the high school teachers) do not have regular opportunities to observe others teaching mathematics. Elementary teachers feel this opportunity would be valuable (70% agree). (see recommendation #4)

It was the opinion of the MTF that the Systematic Program of Continuing Education could potentially have a major impact on mathematics education in West Virginia. A study of the Systematic Program of Continuing Education was recommended. (see recommendation #6)

It was the consensus of the MTF that the school law placing limitations on the scheduling of paid noninstructional days has been detrimental to continuing education in West Virginia. (see recommendation #7) Finally, it was the opinion of the MTF that out-of-specialization authorizations in mathematics for teachers in middle childhood settings not be permitted. (see recommendation #9)

PRIMARY DATA SOURCES

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1. Osborne, A. (Ed.). An Inservice Handbook for Mathematics Education. Reston, VA: National Council of Teachers of Mathematics, 1977.

2. MTF characteristics: 10.2C, 10.2T, 10.3C, 10.2C, 10.6C, 10.4S, 10.3T, 10.4T, 10.5S, 10.1C, 10.1T, 12.6, 12.7.

3. MTF opinion.

Table 3

Percent of Teachers Wanting More Emphasis, the Same Emphasis, or Less Emphasis on Selected Mathematics Content and Methods Topics in Continuing Education Programs

	More Emphasis					Same Emphasis					Less Emphasis				
	E[a]	M	H	S	C	E	M	H	S	C	E	M	H	S	C
Content:															
Algebra	27[b]	46	57	42	47	59	50	41	59	51	14	4	2	0	2
Applications	83	85	84	92	88	17	14	16	8	12	0	1	0	0	0
Calculators	31	39	50	75	51	43	38	41	25	37	26	23	9	0	12
Calculus	20	27	51	25	25	57	56	36	67	35	23	18	14	8	40
Computer Literacy	33	45	67	83	88	51	46	29	17	7	15	9	4	0	5
Geometry	34	40	56	50	47	54	55	43	50	49	12	5	2	0	5
Measurement	58	54	53	67	47	39	43	44	33	42	3	2	3	0	12
Probability & Statistics	29	35	56	67	74	55	53	36	25	21	16	12	7	8	5
Problem Solving	83	86	83	100	93	16	12	17	0	7	1	2	0	0	0
Proof/Reasoning	63	53	62	58	53	30	40	34	33	28	6	7	4	8	19
Structure	46	44	44	42	49	50	46	46	58	37	4	9	10	0	14
Methods:															
Audio-visual	64	48	52	67	65	36	45	44	33	23	1	7	4	0	12
Careers	60	70	80	92	70	37	28	18	8	30	3	1	2	0	0
Concepts	80	86	82	100	77	19	13	17	0	19	1	1	1	0	5
Diagnosis/Remediation	77	73	73	92	65	21	25	26	8	30	2	2	1	0	5
Evaluating Materials	58	52	52	67	61	40	43	45	33	30	1	5	4	0	9
Evaluation	68	64	61	83	51	31	34	36	17	42	1	2	2	0	7
Grouping	75	68	73	92	49	25	30	23	0	47	0	1	5	8	5
Learning Math	77	78	76	92	56	22	20	23	8	35	1	2	2	0	9
Long-range Planning	57	56	62	83	51	41	40	34	17	40	3	4	4	0	9
Management Strategies	68	69	60	92	49	28	29	35	8	40	3	2	5	0	12
Mainstreaming	43	39	38	83	33	42	42	41	8	47	15	19	21	8	21
Manipulatives	72	61	58	83	40	27	32	38	17	49	1	7	4	0	12
Non-college Bound	66	83	80	92	65	31	16	19	8	33	2	1	1	0	2
Problem Solving	84	90	82	100	86	15	10	17	0	14	1	0	1	0	0
Reading in Math	75	76	76	100	67	23	23	21	0	28	2	1	3	0	5

[a] E - elementary school teachers
M - middle/junior high school teachers
H - high school teachers
S - supervisors
C - college persons

[b] Percents are rounded to the nearest whole number.

NEED AREA: CONTINUING EDUCATION

NEED STATEMENT: ALL TEACHERS OF MATHEMATICS NEED TO PARTICIPATE IN A VARIETY OF CONTINUING EDUCATION EXPERIENCES DIRECTLY RELATED TO THE TEACHING OF MATHEMATICS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop annual continuing education requirements for all teachers of mathematics in grades K-12, and require counties to provide this continuing education within the 200-day employment term of teachers.	1. Provide at least the required mathematics continuing education within the 200-day employment term of teachers.	1. Orient all new teachers with respect to the school's philosophy, materials, and so forth for the school's mathematics program.	
2. Encourage all teachers of mathematics (grades K-12) to pursue graduate study in mathematics education. 2.1 Assess the availability of mathematics education graduate study in various regions of West Virginia. 2.2 Assist the institutions of higher education to provide mathematics education graduate study in regions where such study is not available. 2.3 Propose legislation to provide tuition-free graduate study for teachers in mathematics education.	2. Encourage all teachers of mathematics (grades K-12) to pursue graduate study in mathematics education.	2. Encourage all teachers of mathematics (grades K-12) to pursue graduate study in mathematics education.	2. Pursue graduate study in mathematics education.
	3. Facilitate teachers' participation in professional meetings related to the teaching and learning of mathematics.	3. Facilitate teachers' participation in professional meetings related to the teaching and learning of mathematics.	3. Attend professional meetings related to the teaching and learning of mathematics.
	4. Provide teachers the opportunity to observe others teaching mathematics.	4. Provide teachers the opportunity to observe others teaching mathematics.	4. Observe others teaching mathematics.
		5. Subscribe to journals related to the teaching and learning of mathematics (e.g., *Arithmetic Teacher*, *The Mathematics Teacher*).	5. Read journals related to the teaching of mathematics.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
6. Study the effects of the Systematic Program of Continuing Education with respect to its effects on the quantity and quality of mathematics programs offered in the counties and with respect to its effects on mathematics achievement.			
7. Recommend to the State Legislature that the statement in School Law 18A-4-2a concerning the limitation on the scheduling of paid noninstructional days be deleted.			
	8. Provide more emphasis on the following content and methods areas in continuing education programs. 8.1 Provide more emphasis on the following content areas for teachers at all levels. 8.1.1 applications 8.1.2 problem solving 8.1.3 measurement 8.1.4 proof and logical reasoning 8.2 Provide more emphasis on the following content areas for teachers of mathematics at the adolescent education level. 8.2.1 computer literacy 8.2.2 calculators 8.2.3 algebra 8.2.4 geometry 8.2.5 probability & statistics 8.2.6 calculus		

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
	8.3 Provide more emphasis on the following areas concerned with methods of teaching mathematics for all teachers of mathematics. 8.3.1 reading in mathematics 8.3.2 evaluating student learning 8.3.3 how children learn mathematics 8.3.4 classroom management & discipline 8.3.5 strategies for teaching mathematical concepts 8.3.6 teaching problem solving 8.3.7 teaching noncollege-bound students 8.3.8 grouping students for mathematics instruction 8.3.9 diagnosis and prescription 8.3.10 using manipulative aids 8.3.11 evaluating instructional materials 8.3.12 long-range planning 8.3.13 careers related to mathematics		
9. Do not permit out-of-specialization authorizations in mathematics for teachers in middle childhood education settings.			

NEED AREA CURRICULUM DEVELOPMENT AND EVALUATION

OVERVIEW

One of the best ways to improve mathematics education in West Virginis is to initiate a process for continual curriculum development and evaluation in the area of mathematics at the State, county, and school levels. The recommendations in this section identify several actions that can be taken by the West Virginia Department of Education related to the establishment of sound curriculum development and evaluation practices related to mathematics. Also, the recommendations address topics such as mathematics program objectives, standards for successful mathematics programs, and a statewide system of curriculum development and evaluation related to mathematics.

NEED STATEMENT

There is a need to establish effective mathematics curriculum development and evaluation procedures at the State, county, and school levels.

DATA SYNTHESIS

There are many components of a successful program of curriculum development and evaluation related to mathematics. In the opinion of the MTF, the foundation for curriculum development and evaluation should be statements of objectives for the mathematics program. However, the MTF found that 60% of the responding counties do not have such statements. (see recommendation #1) Also, the MTF felt strongly that the West Virginia Department of Education should use the "Characteristics of Successful Mathematics Programs" identified by the MTF as a basis for developing "Standards for Successful Mathematics Programs" and that these Standards, along with corresponding evaluative criteria, should be used for program improvement at all levels. (see recommendation #2)

Another component of mathematics curriculum development and evaluation is a written plan for program improvement. The majority of respondents to the MTF survey felt that written plans for improving the mathematics program should exist at all levels (State, county, and school) (65% of the teachers, 95% of the superintendents, 100% of the supervisors, and 81% of the laypersons). Regrettably, 56% of the responding counties do not have a written plan, but of these counties, 90% think one would be useful. (see recommendation #3)

In the opinion of the MTF, teachers should have meetings specifically for the purpose of examining the mathematics program. However, 60% of elementary teachers did not have any during the school year 1978-79, and 60% of middle school and high school teachers report they do not have department or team meetings on a regular basis. Also, the MTF found that more high-gain middle/junior high schools have department or team meetings than do low-gain schools. Similarly, more high-achievement/high-gain senior high schools, compared to low-achievement/low-gain schools, have such meetings. (see recommendation #3)

A formal testing program is another component of a curriculum development and evaluation system. The MTF found that 96%, 89%, and 92% of the elementary school, middle/junior high school, and senior high school principals, respectively, use data from the State-County Testing Program (SCTP). Also, 40% of the elementary schools, 89% of the middle/junior high schools, and 44% of the senior high schools use testing programs in addition to the SCTP. (see recommendation #4)

It was the opinion of the MTF that principals should observe teachers for the purpose of improving mathematics instruction. Although over 90% of the superintendents and supervisors surveyed by the MTF agreed with this, only 37% of the teachers agreed. However, more teachers in low-achievement/low-gain schools felt a need to be observed than teachers in high-achievement/high-gain schools. (see recommendation #5)

The MTF found that approximately 70% of all mathematics educators believe that planned communication between teachers and guidance counselors should exist, but only 42% of middle/junior high school teachers and 63% of senior high school teachers have such planned communication. (see recommendation #6)

Finally, it was the opinion of the MTF that planned communication with the public should be established at all levels. (see recommendation #7)

PRIMARY DATA SOURCES

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1. MTF characteristics: 1.8S, 3.1C, 3.3C, 3.2S, 3.8C, 3.4S, 3.5S, 3.10S, 3.11S, 10.1S.
2. MTF opinion.

NEED AREA: CURRICULUM DEVELOPMENT AND EVALUATION

NEED STATEMENT: THERE IS A NEED TO ESTABLISH EFFECTIVE MATHEMATICS CURRICULUM DEVELOPMENT AND EVALUATION PROCEDURES AT THE STATE, COUNTY, AND SCHOOL LEVELS

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop mathematics program objectives for grades K-12.	1. Develop mathematics program objectives for grades K-12 modeled after those developed by the West Virginia Department of Education and review the program objectives every five years.	1. Adopt the county K-12 mathematics program objectives.	1. Implement the county mathematics program objectives.
1.1 Identify objectives based on the definition of Basic Skills in Mathematics (see Basic Skills in Mathematics recommendation #1 p. 31).			
1.2 Compare the objectives to the items on the State-County Testing Program and distribute the findings to each county.			
1.3 Review the objectives every five years.			
2. Develop "Standards for Successful Mathematics Programs."	2. Implement the "Standards for Successful Mathematics Programs."	2. Implement the "Standards for Successful Mathematics Programs."	2. Implement the "Standards for Successful Mathematics Programs."
2.1 Use the "Characteristics of Successful Mathematics Programs" identified by the Mathematics Task Force and the relevant data from the Task Force Study as a basis for developing Standards (see Appendix F and G).			
2.2 Develop four levels of "Standards for Successful Mathematics Programs," State, county, school, and classroom/teacher.			
2.3 Develop evaluative criteria to assess the implementation of the "Standards for Successful Mathematics Program."			
2.4 Assist counties in utilizing the evaluative criteria.			

NEED AREA: CURRICULUM DEVELOPMENT AND EVALUATION

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
3. Develop a mathematics curriculum development and evaluation system.	3. Develop a mathematics curriculum development and evaluation system.	3. Develop a mathematics curriculum development and evaluation system.	
3.1 Develop a written State plan for improving the mathematics program that reflects the county plans, data from the State-County Testing Program, and the State evaluative criteria.	3.1 Develop and submit to the WVDE a written county plan for improving the mathematics program that reflects the school plans, data from the State-County Testing Program, and the county evaluative criteria.	3.1 Develop and submit to the county a written plan for improving mathematics achievement that reflects students' needs, data from the State-County Testing Program, and the school and classroom teacher evaluative criteria.	
3.2 Conduct a yearly review of the written state plan.	3.2 Conduct a yearly review of the written county plan.	3.2 Conduct a yearly review of the written school plan.	
3.3 Encourage each county to include curriculum development and evaluation activities in its continuing education program.	3.3 Include curriculum development and evaluation activities in the continuing education program.	3.3 Include faculty meetings specifically concerned with the improvement of the mathematics program.	
3.4 Assist each county in the development of its mathematics curriculum development and evaluation system.	3.4 Assist each school in the development of its mathematics curriculum development and evaluation system.		
4. Provide technical assistance to counties in the interpretation and use of data from the State-County Testing Program.	4. Provide technical assistance to schools in the interpretation and use of data from the State-County Testing Program.	4. Assist teachers and counselors in the interpretation and use of data from the State-County Testing Program.	
5. Develop observation guidelines specifically for the teaching of mathematics.	5. Provide continuing education for principals concerning the observation of teachers for improving mathematics instruction.	5. Observe teachers for the purpose of improving mathematics instruction.	
5.1 Develop separate mathematics observation guidelines for different grade levels and courses (e.g., K, 1-4, Algebra I).			
5.2 Develop continuing education packets for principals concerning the use of the observation guidelines.			

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
		6. Establish planned communication between counselors and teachers of mathematics.	6. Communicate with counselors concerning students and the mathematics program.
7. Establish planned communication with the public concerning curriculum development and evaluation in the area of mathematics.	7. Establish planned communication with the public concerning curriculum development and evaluation in the area of mathematics.	7. Establish planned communication with the public concerning curriculum development and evaluation in the area of mathematics.	7. Establish planned communication with parents.

NEED AREA INSTRUCTIONAL MATERIALS

OVERVIEW

Instructional materials are of two types: basal and supplementary.

Increased attention must be given to basal instructional materials in local mathematics program adoptions. In many areas of mathematics, manipulative materials are essential to the learning of mathematics. Recognition must be given to the integral part manipulative aids and other instructional materials play in the teaching and learning of mathematics. This can be done via the basal program adoption process.

Supplementary instructional materials are an integral part of a successful mathematics program. The MTF found strong data supporting the need for supplementary materials to be provided for teachers. Increased attention must be given to the provision of appropriate supplementary instructional materials.

NEED STATEMENT

All teachers need to have available an appropriate quantity and quality of mathematics instructional materials.

DATA SYNTHESIS

There are two types of mathematical instructional materials. First, there are those instructional materials that comprise the basal instructional program. Usually, these materials consist of a textbook and the aids (e.g., manipulative aids) needed to implement the activities developed in the text. However, the MTF found evidence to suggest that the mathematics textbook is the core of the basal program. In particular, the MTF found that 80% of all teachers report using the textbook on a daily basis. It was the opinion of the MTF that the objectives of all K-8 textbook series be carefully examined (see recommendation #1) and that all teachers be provided the necessary materials to properly utilize the adopted textbook. (see recommendations #2 and #3)

The second type of instructional material is supplementary material. Supplementary material can be used for the following purposes (NCTM, 1973):

- to keep the curriculum up-to-date;
- to incorporate experimental aspects of curriculum development;
- to provide material not required by various curriculum guides; and
- to provide materials whose primary purpose is recreation, application, or individualized drill and practice and which are not adaptable to the standard textbook format.

The MTF survey found strong support for the use of and need for supplementary mathematics instructional materials. In particular, supplementary material was found to be the greatest area of need, from the open-ended questionnaires, by teachers and principals at all levels. Also, on the open-ended questionnaire from elementary and middle/junior high school teachers and principals and from senior high school principals, supplementary materials was one of the most frequent responses when asked to identify the greatest strength of their program. Although supplementary material is an important component of the instructional program, few teachers have guidelines for selecting such material (74%, 55%, and 65% of the elementary, middle/junior high, and senior high school teachers, respectively, do not have guidelines). (see recommendation #4) Furthermore, most teachers believe they do not have an adequate inventory of mathematics material in their school (36%, 45%, and 40% of the elementary, middle/junior high, and senior high teachers believe they have an adequate inventory), and most people believe a resource center for mathematics should exist in every school (87% of all respondents agree). (see recommendation #5)

Finally, it was the opinion of the MTF that not only are the objectives of a textbook and other instructional material important, but that all instructional material should be free of culture and sex biases. (see recommendation #6)

PRIMARY DATA SOURCES

1. National Council of Teachers of Mathematics (NCTM), Instructional Aids in Mathematics (34th yearbook). Washington, D.C.: NCTM, 1973.
2. MTF characteristics: 1.11S, 1.5C, 3.7C, 6.1C, 6.1S, 6.6T, 6.5S, 6.9T, 6.3C.
3. MTF opinion.

NEED AREA: INSTRUCTIONAL MATERIALS

NEED STATEMENT: ALL TEACHERS NEED TO HAVE AVAILABLE AN APPROPRIATE QUANTITY AND QUALITY OF MATHEMATICS INSTRUCTIONAL MATERIALS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Include in the Specific Criteria for Mathematics Adoptions an analysis of each series with respect to: 1.1 the competencies included in Mathematics for West Virginia Schools, K-8; 1.2 the objectives associated with the items on the mathematics portion of the West Virginia State-County Testing Program.	1. Develop criteria for selecting mathematics textbooks in grades K-12 using the Specific Criteria for Mathematics Adoptions as a guide.	1. Utilize the county criteria for selecting textbooks.	
2. Provide a list of instructional materials and manipulative aids necessary to implement each of basal mathematics programs on the Official State Multiple List in a mathematically and pedagogically sound manner.	2. Adopt the necessary instructional materials and manipulative aids needed to properly implement the basal program.	2. Adopt the necessary instructional materials and manipulative aids needed to properly implement the basal program.	2. Use the necessary instrucational materials and manipulative aids needed to properly implement the basal program.
3. Recommend that the legislature appropriate funds specifically to provide each child with the necessary basal instructional materials, including manipulative aids.			
4. Develop guidelines for evaluating supplementary instructional materials for mathematics programs.	4. Provide supplementary instructional materials to enhance and extend the basal program. 4.1 Involve teachers in the selection of supplementary instructional materials. 4.2 Utilize the WVDE guidelines to evaluate supplementary instructional materials.	4. Provide supplementary instructional materials to enhance and extend the basal program. 4.1 Involve teachers in the selection of supplementary instructional materials. 4.2 Utilize the WVDE guidelines to evaluate supplementary instructional materials.	4. Use supplementary instructional materials appropriate to the students' age and stage of development to enhance and extend basal mathematics program.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
	5. Provide all teachers with an inventory of all mathematics instructional materials located at the county media center and at the RESA media center.	5. Establish a resource center specifically for mathematics instructional materials with an inventory available to all teachers.	
6. Select textbooks and other instructional materials that reflect a multicultural and nonsexist point of view related to the teaching and learning of mathematics. 6.1 Provide the West Virginia Textbook Adoption Committee with guidelines for evaluating textbooks with regard to culture and sex biases. 6.2 Develop guidelines for counties concerning ways to evaluate instructional materials for culture and sex biases.	6. Select textbooks and other instructional materials that reflect a multicultural and nonsexist point of view related to the teaching and learning of mathematics.	6. Select textbooks and other instructional materials that reflect a multicultural and nonsexist point of view related to the teaching and learning of mathematics.	6. Select instructional materials that reflect a multicultural and nonsexist point of view related to the teaching and learning of mathematics.

NEED AREA INSTRUCTIONAL PRACTICES

OVERVIEW

The West Virginia Department of Education and administrative personnel exist to support the teaching-learning process. Although there is much that can be controlled at an administrative level that affects student learning (e.g., instructional time, class size, and availability of instructional materials), once in the classroom, the instructional practices of the teacher are the key factors affecting student achievement.

Considerable research is currently being done on the structuring of class time. This research is identifying several effective generic instructional practices as well as other instructional practices specifically related to mathematics.

The West Virginia Department of Education and administrators must facilitate the use of effective instructional practices for the teaching of mathematics. The recommendations in this section identify several effective instructional practices and ways teachers can be assisted to implement these practices.

NEED STATEMENT

There is a need to facilitate the use of effective instructional practices for the teaching and learning of mathematics.

DATA SYNTHESIS

An examination of the research on instructional practices shows that there are some areas which have been the focus of extensive research. For example, the cognitive movement (Wittrock, 1979) appears to be well established in educational research, and a large number of research efforts continue in such areas as questioning (Andre, 1979), advance organizers (Mayer, 1979), aptitude-treatment interactions (Witkins, et al., 1977), and individual differences (Snow, 1977; Gehlbach, 1979).

In mathematics education, research concerned with effective instructional practices is relatively new. However, the research that exists suggests that certain instructional practices are probably more effective than others.

Suydam and Dessart (1976) provide an excellent review of research on computational skills. Also, Suydam and Higgins (1977) have identified some "recommendations from research" concerned with activity-based learning. These reviews suggest a number of conclusions related to effective instructional practices that deserve to be mentioned. (see recommendation #2)

(1) "Lessons using manipulative materials have a higher probability of producing greater mathematical achievement than do nonmanipulative lessons" (Suydam & Higgins, 1977, p. 83).

(2) "The inclusion of the concrete state in sequences of instruction - that is, leading from concrete to pictorial to symbolic - is highly plausible" (Suydam & Higgins, 1977, p. 83).

(3) "The use of materials appears to be effective with children at all achievement levels, ability levels, and socioeconomic levels, although data are sparse" (Suydam & Higgins, 1977, p. 84).

(4) "The use of manipulative materials is of some importance for all grade/age levels in the elementary school" (Suydam & Higgins, 1977, p. 84).

(5) "Certain games can be used to promote specific learning outcomes" (Suydam & Higgins, 1977, p. 84).

(6) Drill should be used only after meaningful instruction (Suydam & Dessart, 1976, p. 21).

(7) Systematic and regular review and practice should be provided (Suydam & Dessart, 1976, p. 25).

In addition to the conclusions above, a current research effort (Good & Grouws, 1979) is showing strong support for the use of such practices as daily review, practice, homework, and mental calculation. In West Virginia, a study similar to Good's and Grouw's is currently underway in Wood County to examine the effects of planned review, meaningful development, and problem solving experiences. Pilot test results for this work in West Virginia support the use of these practices.

The MTF survey collected a large amount of data on instructional practices. The data are summarized on the attached tables. One can observe in the tables that many potentially valuable instructional practices are seldom used by teachers at all levels (e.g., manipulative aids). Other instructional practices may indeed be used too frequently (e.g., "worksheets"). (see recommendations #2, #3, and #4)

Finally, the use of diagnostic and prescriptive practices when teaching mathematics to all students is considered essential by mathematics educators. Also, the MTF study found that 64% of the elementary teachers, 78% of middle/junior high school teachers, 72% of the high school teachers, and over 80% of the superintendents and supervisors believe that mathematics programs should be based on a diagnostic/prescriptive approach. Regrettably, only 8%, 7% and 6% of the elementary, middle/junior high, and high school teachers, respectively, report that their programs are based on a diagnostic/prescriptive approach. (see recommendation #1)

PRIMARY DATA SOURCES

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1. Wittrock, M.C.. The cognitive movement in instruction. Educational Researcher, 8 (2), 1979, pp. 5-11.

2. Andre, T. Does answering higher level questions while reading facilitate productive learning? *Review of Education Research*, *49* (2), 1979. pp. 280-318.

3. Mayer, R.E. Can advance organizers influence meaningful learning? *Review of Educational Research*, *49* (2), 1979, pp. 371-383.

4. Witkin, H.A., et al. Field-dependent and field-independent cognitive styles and their educational implications. *Review of Educational Research*, *47* (1), 1977, pp. 1-64.

5. Snow, R.E. Individual differences and instructional theory. *Educational Researcher*, *6* (10), 1977, pp. 11-15.

6. Gehlbach, R.D. Individual differences: Implications for instructional theory, research, and innovation. *Educational Researcher*, *8* (4), 1979, pp. 8-14.

7. Suydam, M.N. & Dessart, D.J. *Classroom ideas from research on computational skills.* Reston, VA: National Council of Teachers of Mathematics, 1976.

8. Suydam, M.N. & Higgins, J.L. *Activity-based learning in elementary school mathematics: Recommendations from research*. Columbus, Ohio: ERIC, 1977.

9. Good, T.L. & Grouws, D.A. The Missouri Mathematics Effectiveness Project: An experimental study in fourth grade classrooms. *Journal of Educational Psychology*, *71* (3), 1979, pp. 355-362.

10. MTF characteristics: 6.3T, 6.4T, 7.1T, 7.2T, 7.5T, 7.6T, 8.1T, 8.3T, 9.1T, 5.5C, 5.11S, 5.1T, 7.7T.

Table 4

Frequency of Use of Selected Instructional Practices by Elementary School Teachers

	daily[a]	weekly	monthly	yearly	never
applications	61[b]	23	14	1	1
basal text	80	9	3	0	8
bulletin board	5	8	40	34	13
calculators	2	4	6	9	80
chalkboard	36	49	13	1	1
community resources	0	1	3	16	80
computer literacy	1	2	3	6	89
estimating computations	12	27	31	11	19
estimating measurements	4	17	45	23	11
field trips	1	1	3	28	68
films & filmstrips	1	7	39	26	27
games	18	50	26	4	3
homework	22	34	18	7	19
life skills	6	21	43	21	9
manipulatives	31	32	27	7	4
math in careers	4	13	29	27	28
mental computation	63	22	11	2	3
other media	5	13	37	16	29
outside activities	1	6	20	29	44
overhead	3	12	28	15	42
practice/drill	73	21	4	1	0
problem solving	30	45	20	2	3
review	7	35	55	3	1
supplementary material	31	44	20	3	2
television	4	13	12	8	63
workbooks	41	11	4	1	43
worksheets	52	37	9	1	2

[a] daily - once each day
weekly - about once a week
monthly - about once a month
yearly - about once a year
never - never used

[b] Percents are rounded to the nearest whole number.

Table 5

Frequency of Use of Selected Instructional Practices by Middle/Junior High School Teachers

	daily[a]	weekly	monthly	yearly	never
applications	44	38	16	2	0
basal text	82	9	4	2	3
bulletin board	8	6	44	26	16
calculators	4	4	12	16	64
chalkboard	31	45	18	4	2
community resources	0	0	1	24	75
computer literacy	1	2	7	18	72
estimating computations	16	32	37	12	2
estimating measurements	3	17	48	28	5
field trips	0	0	1	14	85
films & filmstrips	0	5	30	37	29
games	4	27	47	16	6
homework	64	28	6	1	2
life skills	7	30	39	20	4
manipulatives	7	24	40	20	9
math in careers	5	23	40	24	8
mental computation	54	26	15	3	2
other media	0	8	27	31	35
outside activities	0	2	10	34	55
overhead	12	16	22	18	31
practice/drill	64	28	7	0	0
problem solving	24	53	20	2	1
review	5	30	6	4	0
supplementary material	19	43	28	4	6
television	0	2	4	7	88
workbooks	9	14	7	4	66
worksheets	25	54	16	2	3

[a] daily - once each day
weekly - about once a week
monthly - about once a month
yearly - about once a year
never - never used

[b] Percents are rounded to the nearest whole number.

NEED AREA: INSTRUCTIONAL PRACTICES

NEED STATEMENT: THERE IS A NEED TO FACILITATE THE USE OF EFFECTIVE INSTRUCTIONAL PRACTICES FOR THE TEACHING AND LEARNING OF MATHEMATICS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop continuing education packets concerning the use of diagnostic and prescriptive practices for all students when teaching mathematics.	1. Conduct continuing education programs concerning the use of diagnostic and prescriptive practices for all students when teaching mathematics.	1. Assist teachers to utilize diagnostic and prescriptive practices for all students when teaching mathematics.	1. Utilize diagnostic and prescriptive practices for all students when teaching mathematics.
2. Develop continuing education packets concerned with the following instructional practices	2. Conduct continuing education programs concerned with the following instructional practices:	2. Assist teachers to implement the following instructional practices:	2. Implement the following instructional practices:
2.1 utilizing a variety of methods to meet individual learning styles and interests;	2.1 utilizing a variety of methods to meet individual learning styles and interests;	2.1 utilizing a variety of methods to meet individual learning styles and interests;	2.1 utilizing a variety of methods to meet individual learning styles and interests;
2.2 utilizing manipulative aids and activity-based experiences to develop an understanding of concepts, facts, and skills;	2.2 utilizing manipulative aids and activity-based experiences to develop an understanding of concepts, facts, and skills;	2.2 utilizing manipulative aids and activity-based experiences to develop an understanding of concepts, facts, and skills;	2.2 utilizing manipulative aids and activity-based experiences to develop an understanding of concepts, facts, and skills;
2.3 providing practice with concepts, facts, and skills using a variety of methods including homework and instructional games;	2.3 providing practice with concepts, facts, and skills using a variety of methods including homework and instructional games;	2.3 providing successful practice with concepts, facts, and skills using a variety of methods including homework and instructional games;	2.3 providing successful practice with concepts, facts, and skills using a variety of methods including homework and instructional games;
2.4 using mental calculation activities on a daily basis;	2.4 using mental calculation activities on a daily basis;	2.4 using mental calculation activities on a daily basis;	2.4 using mental calculation activities on a daily basis;
2.5 providing daily review activities to maintain understanding and proficiency;	2.5 providing daily review activities to maintain understanding and proficiency;	2.5 providing daily review activities to maintain understanding and proficiency;	2.5 providing daily review activities to maintain understanding and proficiency;
2.6 providing daily problem solving experiences.	2.6 providing daily problem solving experiences.	2.6 providing daily problem solving experiences.	2.6 providing daily problem solving experiences.
3. Encourage and facilitate participation for all students in mathematics projects, clubs, contests, field trips, math field days, etc.	3. Encourage and facilitate participation for all students in mathematics projects, clubs, contests, field trips, math field days, etc.	3. Encourage and facilitate participation for all students in mathematics projects, clubs, contests, field trips, math field days, etc.	3. Encourage and facilitate participation for all students in mathematics projects, clubs, contests, field trips, math field days, etc.
4. Identify and implement ways to increase the use of instructional television for teaching mathematics.	4. Identify and implement ways to increase the use of instructional television for teaching mathematics.	4. Identify and implement ways to increase the use of instructional television for teaching mathematics.	4. Use instructional television for teaching mathematics.

NEED AREA

INSTRUCTIONAL TIME

OVERVIEW

One of the basic factors affecting mathematics achievement is that of instructional time. This factor has been recently emphasized by studies such as the Beginning Teacher Evaluation Study. This recent research is emphasizing not only the scheduled instructional time, but also the maximum use of that time. The concept of "engaged time," or the time students are actively engaged in learning, must be emphasized at all levels. The MTF found a very strong relationship between instructional time in mathematics and mathematics achievement.

NEED STATEMENT

There is a need to maximize the amount of time students are actively involved in the learning of mathematics.

DATA SYNTHESIS

Instructional time has been identified by many as a major factor affecting student achievement. Furthermore, there are two components to the concept of instructional time. One component is the amount of time scheduled for teaching mathematics. For example, some teachers schedule 45 minutes each day for mathematics instruction. In West Virginia, secondary schools are required to schedule an average of at least 225 minutes per week for mathematics (WVDE, 1966). However, at the elementary and middle school levels, there is no minimum time requirement for mathematics. In fact, in West Virginia the only time requirement at the elementary level is for physical education (30 minutes per day). Across the country, a recent survey shows that only 25% of the states and 40% of the school districts have minimum time requirements for mathematics (Suydam & Osborne, 1977). However, another review of the literature on class time shows that there is a trend to increase the amount of class time devoted to mathematics and, at the elementary level, the average amount of time given to mathematics is 43 minutes (NACOME, 1975).

The MTF survey found that 73% of the responding counties do not have minimum time requirements for the teaching of mathematics. However, the MTF also found that both mathematics educators and laypersons agree that the West Virginia Board of Education should establish a minimum time requirement for mathematics at the elementary level (66% of the elementary teachers, 71% of the middle/junior high school teachers, 63% of the high school teachers, 66% of the superintendents, 100% of the supervisors, 77% of the college persons; and 81% of the laypersons agreed). (see recommendation #1)

From the MIF principals' surveys, a difference of time spent in mathematics was found between high-gain and low-gain schools (see table below). In particular, at all grade levels K through 6, the high-gain schools, on the average, spend more time teaching mathematics than do low-gain schools.

Table 6
Mean Number of Minutes Per Day Teaching Mathematics

GRADE	ACHIEVEMENT	
	HIGH-GAIN	LOW-GAIN
K	28.8 min.	26.4 min.
1	48.7	45.0
2	52.3	48.1
3	54.2	48.9
4	54.4	52.8
5	56.5	50.9
6	57.4	52.1

The second component of instructional time is the amount of time within the period scheduled for mathematics that students are actively engaged in mathematics learning activities. The Beginning Teacher Evaluation Study (BTES) has found that engaged time is indeed one of the most important facto affecting student achievement. A summary of the Study's conclusion related to engaged time shows the importance placed on this variable (The Science Teacher, 1979, p. 39). (see recommendation #2)

> "The six-year study of classroom practices found that the number of hours actually spent working influenced pupils' learning more than any other factor, including methodology, educational philosophy, availability of technology, or classroom structure. In many classrooms, it was reported, pupils spent a maximum of 100 hours during the 180-day school year at reading or math." (p. 39).

PRIMARY DATA SOURCES

1. West Virginia Department of Education. Secondary Schools: Standards for Classification. Charleston, West Virginia: West Virginia Department of Education, 1966.

2. Suydam, M.N. & Osborne, A. The Status of Pre-college Science, Mathematics, and Social Science Education: 1955-75; Volume II, Mathematics Education. The Ohio State University: ERIC, 1977.

3. Conference Board of the Mathematical Sciences and the National Advisory Committee on Mathematical Education (NACOME). Overview and Analysis of School Mathematics K-12. Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

4. Learning and the constraints of time. The Science Teacher, 46 (5), 1979. p. 39.

5. MTF characteristic: 12.3.

NEED AREA: INSTRUCTIONAL TIME

NEED STATEMENT: THERE IS A NEED TO MAXIMIZE THE AMOUNT OF TIME STUDENTS ARE ACTIVELY INVOLVED IN THE LEARNING OF MATHEMATICS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Recommend to the West Virginia Board of Education that a policy be adopted which identifies the following minimal instructional times for mathematics in grades K-12: 1.1 grade K to be taugh daily. 1.2 grades 1-4 to be taught 55 minutes daily. 1.3 grades 5-8 to be taught 275 minutes weekly. 1.4 grades 9-12 to be taught 225 minutes weekly.	1. Adopt a policy identifying minimal instructional times for mathematics in grades K through 12 which are equal to or greater than the time requirements identified in the State policy.	1. Schedule an amount of time for mathematics instruction that is equal to or greater than the time requirements identified in the county policy.	1. Schedule an amount of time for mathematics instruction that is equal to or greater than the time requirements identified in the county policy.
2. Communicate to counties the research findings concerning the relationship between student achievement and the amount of time students are actively involved in mathematics learning activities.	2. Conduct a continuing education program for principals and teachers concerning techniques for maximizing the amount of time each student is actively involved in mathematics learning activities.	2. Assist teachers to maximize the amount of time each student is actively involved in mathematics learning activities.	2. Maximize the amount of time each student is actively involved in mathematics learning activities.

NEED AREA MATHEMATICS TEACHERS

OVERVIEW

There is currently a crisis in the supply of certified mathematics teachers. Of the many factors that may have created the critical shortage, two stand out. One of the factors appears to be the elimination of the single-field certification option for secondary mathematics teachers (see Teacher Education). Another factor is in the recruitment area. Pre-college students, high school students, and the general public need to be informed of the career opportunities in teaching mathematics, and a recruitment program must be developed.

NEED STATEMENT

There is an urgent need to increase the number of mathematics teachers.

DATA SYNTHESIS

Within the past five years, many educators have come to realize that a serious shortage of mathematics teachers exists and will continue to exist for several years to come unless some action is taken. In West Virginia, the 1978-79 school year started with 25 openings in secondary mathematics. Furthermore, data collected by the MTF study suggest that the apparent shortage of mathematics teachers in West Virginia will continue (see table below).

The MTF identified several actions that can be taken by the WVDE to deal with the serious shortage of mathematics teachers. (see recommendations #1, #2, and #3)

Table 7

TOTAL NUMBER OF GRADUATES WITH SPECIFIC MATHEMATICS SPECIALIZATIONS FROM WEST VIRGINIA COLLEGES AND UNIVERSITIES	7-12 Mathematics Specialization	7-9 Mathematics Specialization	4-8 Mathematics Specialization
Students graduated in 1976-77	54	16	37
Students graduated in 1977-78	11	16	36
Students graduated in 1978-79	24	14	23
Students to graduate in 1979-80	14	12	18

PRIMARY DATA SOURCES

1. College survey.
2. MTF opinion.

NEED AREA: MATHEMATICS TEACHERS

NEED STATEMENT: THERE IS AN URGENT NEED TO INCREASE THE NUMBER OF MATHEMATICS TEACHERS.

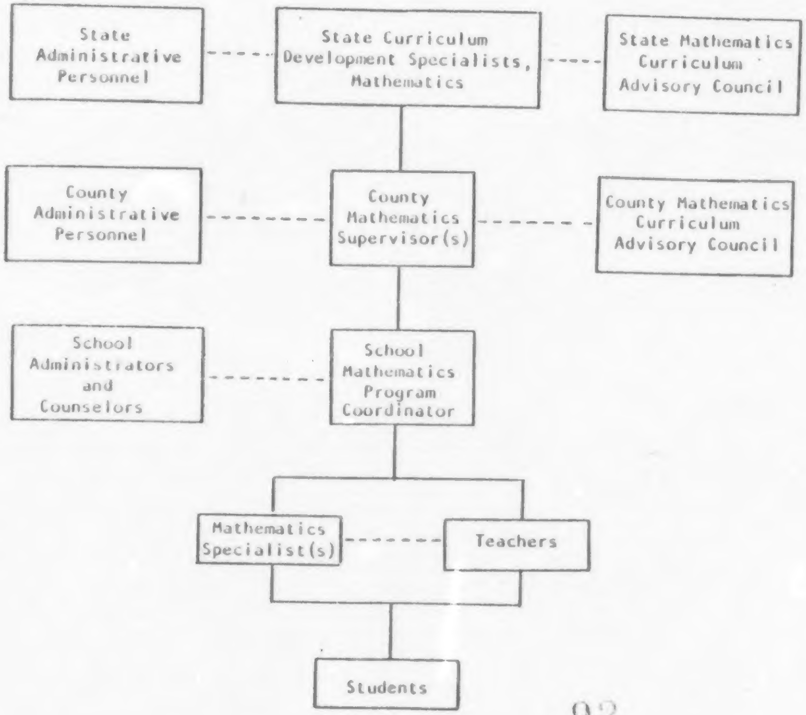
DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop a teacher education recruitment program for mathematics teachers with involvement from groups such as colleges, West Virginia Council of Teachers of Mathematics, and laypersons.			
2. Develop an incentive program for recruiting, training, and retaining mathematics teachers.			
3. Communicate with the public and the educational community information concerning the shortage of secondary mathematics teachers through means such as newspapers and newsletters.	3. Communicate with the public and the educational community information concerning the shortage of secondary mathematics teachers through means such as newspapers and newsletters.	3. Communicate with the public information concerning the shortage of secondary mathematics teachers through means such as newspapers and newsletters.	3. Encourage students to pursue mathematics teaching as a career.

NEED AREA ORGANIZATIONAL NETWORK

OVERVIEW

Coordination, communication, and leadership are critical components of any successful mathematics program. All of the recommendations in this section are concerned with the personnel and groups needed to provide adequate coordination, communication, and leadership at the State, county, and school levels. The chart below illustrates the organization network reflected by the MTF recommendations. In the opinion of the MTF, establishing the organizational network provided in this report is a necessary step in the improvement of mathematics education in West Virginia.

Figure 2: Organizational Network


State Administrative Personnel
State Curriculum Development Specialists, Mathematics
State Mathematics Curriculum Advisory Council
County Administrative Personnel
County Mathematics Supervisor(s)
County Mathematics Curriculum Advisory Council
School Administrators and Counselors
School Mathematics Program Coordinator
Mathematics Specialist(s)
Teachers
Students

NEED STATEMENT

There is a need to establish an organizational network in order to maximize communication, coordination, and leadership among those involved in mathematics.

DATA SYNTHESIS

It was the opinion of the MTF that several types of individuals should exist within a school system to facilitate the development, implementation, and evaluation of successful mathematics programs. First, it was the opinion of the MTF that every county should have at least one mathematics supervisor. The MTF survey found that eight out of 31 responding superintendents report having a mathematics supervisor. Of the 23 that do not, 15 reported that one would be valuable. Also, the majority of all respondents to the MTF survey agreed that each county should have a mathematics supervisor (63%, 72%, and 67% of the elementary, middle/junior high, and senior high school teachers, respectively; 68% of the superintendents; 67% of the college persons; and 66% of the laypersons). (see recommendation #3)

In addition to supervisory personnel, the MTF felt that each school should have a mathematics specialist on the staff to perform functions such as diagnosing learning deficiencies, developing and teaching in remedial and gifted mathematics programs, and assisting the principal in the development and evaluation of the mathematics program. (see recommendation #5)

The MTF found strong support for involving both teachers and principals in leadership roles and curriculum efforts related to mathematics. In particular, 60% of the teachers, 100% of the superintendents and supervisors, and 76% of the laypersons agree that teachers should be used in leadership roles related to mathematics. Further, 59% of the middle/junior high schools report having a department chairperson or team leader (44% receive extra pay and 29% have written job descriptions) and 84% of the senior high schools have such a position (30% receive extra pay and 20% have a written job description). (see recommendation #4)

With regard to principals, the MTF, like the Reading Task Force, found strong support for schools to have supervising, rather than teaching, principals. MTF data show that 10% of the low-gain elementary schools have teaching principals while only 2% of the high-gain schools have teaching principals. (see recommendation #6)

Another component of a mathematics organizational network is curriculum advisory councils. In the opinion of the MTF, mathematics curriculum advisory councils should exist at both the State and county levels. (see recommendation #1)

Finally, it was the opinion of the MTF that one State Curriculum Development Specialist, Mathematics is insufficient. (see recommendation #2)

PRIMARY DATA SOURCES

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1. MTF characteristics: 1.13S, 1.14S, 2.1C, 2.2C, 2.1S, 2.2S, 2.3C, 2.4C, 2.3S, 2.5C, 2.4S, 2.6C, 2.5S, 3.4C, 3.5C.

2. MTF opinion.

NEED AREA: ORGANIZATIONAL NETWORK

NEED STATEMENT: THERE IS A NEED TO ESTABLISH AN ORGANIZATIONAL NETWORK IN ORDER TO MAXIMIZE COMMUNICATION, COORDINATION, AND LEADERSHIP AMONG THOSE INVOLVED IN MATHEMATICS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Establish a State Mathematics Curriculum Advisory Council.	1. Establish a County Mathematics Curriculum Advisory Council.		
2. Employ at least two State Curriculum Development Specialists, Mathematics.			
3. Recommend to each county that at least one mathematics supervisor be employed.	3. Employ at least one mathematics supervisor.		
		4. Identify a School Mathematics Program Coordinator.	
5. Recommend to counties that at least one mathematics specialist be employed for every school to serve as a diagnostician; to develop and teach in remedial, enrichment, and gifted mathematics programs; to assist in mathematics program development and evaluation; etc.	5. Employ at least one mathematics specialist for every school to serve as a diagnostician; to develop and teach in remedial, enrichment, and gifted mathematics programs; to assist in mathematics program development and evaluation; etc.	5. Utilize at least one mathematics specialist to serve as a diagnostician; to develop and teach in remedial, enrichment, and gifted mathematics programs; to assist in mathematics program development and evaluation; etc.	
6. Mandate full-time supervising principals.	6. Employ full-time supervising principals.		

NEED AREA ORGANIZING FOR INSTRUCTION

OVERVIEW

The organizational patterns within a county and within a school must serve to support teachers in their efforts to maximize student achievement in mathematics. Furthermore, the organizational patterns within a classroom must serve to best meet the needs of individual learners. The recommendations in this section are aimed at the use of organizational patterns for maximum student learning in mathematics.

NEED STATEMENT

There is a need to organize mathematics classrooms for the most effective instruction.

DATA SYNTHESIS

Organizing classes within the school and organizing groups within the classroom are issues faced constantly by administrators and teachers. The question is frequently raised concerning which organizational patterns should be used to best meet the needs and abilities of students.

A critical issue concerning the organization of classrooms is class size. Recent research indicates ". . . average pupil achievement increases as class size decreases." Moreover, ". . . for every pupil by which class size is reduced below 20, the class' average achievement improves substantially more than for each pupil by which class size is reduced between 20 and 30." (Glass, et al., 1979, p. 43).

Of course, recent state legislation mandates that, by the school year 1983-84, there will be no more than 20 students per each kindergarten session and no more than 25 students per each teacher in grades 1-3.

MTF opinionnaire data show that 94% of the middle/junior high and high school teachers; 86-89% of the superintendents, college teachers, and laypersons; and 75% of the supervisors agree that class size should be limited in grades 7-12 to 15 for remedial classes and 25 for other classes. Middle/junior high school teachers and principals ranked class size third in order of expressed needs on the open-ended survey, while high school teachers ranked it fourth. (see recommendation #1)

The table on the following page summarizes the MTF findings on organization within the classroom. (Note the trend in small group instruction and total class instruction over grade levels.)

DOMINANT GROUPING AS REPORTED ON
ELEMENTARY AND MIDDLE/JUNIOR HIGH PRINCIPALS SURVEY

	K (N=50)	1st (N=61)	2nd (N=63)	3rd (N=63)	4th (N=61)	5th (N=71)	6th (N=91)	7th (N=110)	8th (N=110)	9th (N=67)
INDIVIDUALIZED	12%	3%	2%	3%	2%	4%	2%	1%	0%	0%
SMALL GROUP 2-5	26%	16%	16%	6%	7%	10%	5%	3%	3%	2%
LARGE GROUP 6-15	36%	48%	48%	53%	53%	46%	49%	19%	19%	15%
TOTAL CLASS	24%	31%	33%	36%	36%	37%	41%	75%	76%	81%
OTHER	2%	2%	2%	2%	3%	3%	2%	2%	2%	3%

The table below summarizes the MTF findings concerning grouping patterns within high school courses. (Note the data for remedial mathematics classes.)

DOMINANT GROUPING PATTERNS AS REPORTED ON HIGH SCHOOL PRINCIPALS SURVEY

	INDIVIDUALIZED	SMALL GROUP	LARGE GROUP	TOTAL CLASS
REMEDIAL MATHEMATICS	31%	16%	27%	22%
GENERAL MATHEMATICS	1%	1%	14%	78%
CONSUMER MATHEMATICS	0%	3%	16%	78%
INTRO TO ALGEBRA	0%	4%	20%	73%
ALGEBRA I	0%	0%	17%	80%
GEOMETRY	2%	4%	21%	70%
ALGEBRA II	1%	8%	26%	62%
TRIGONOMETRY	4%	20%	35%	40%
PROBABILITY & STATISTICS	0%	41%	23%	36%
MATH ANALYSIS	7%	18%	31%	41%
ALGEBRA III	4%	22%	15%	56%
CALCULUS	4%	35%	33%	27%

Most people agree that teachers should individualize instruction (74% of the elementary, 58% of the middle/junior high, and 56% of the high school teachers; 71% of the superintendents; 92% of the supervisors; 54% of the college teachers; and 73% of the laypersons). However, no more than 3% of the teachers in grades 1-4, 8% in grade 5, 4% in grade 6, 1% in grade 7, and 0% in grade 8 report that they individualize instruction. In grades 1-9, a greater percentage of high-gain than low-gain schools individualize instruction. In high schools, although less than 7% report individualizing in any mathematics class, 31% do report individualizing in remedial mathematics classes (44% in high-gain schools and 17% in low-gain schools). (see recommendation #4)

Eighty-six percent of elementary teachers agree that flexible grouping should be used in self-contained classrooms. Less than 6% of the high school teachers use flexible grouping in any class. (see recommendation #5)

Educators agree that students should be homogeneously grouped for mathematics instruction (70% of the elementary, 78% of the middle/junior high, and 71% of the high school teachers; 60% of the superintendents; 92% of the supervisors; and 56% of the college teachers); however, the literature and research on the relationship of homogeneous grouping to achievement remains inconclusive. (see Suydam & Weaver, 1975)

It was the opinion of the MTF that physical facilities influence the teacher's ability to use various organizational and instructional patterns and that the physical facilities should be adaptable to a variety of patterns. (see recommendation #3)

Finally, it was also the opinion of the MTF that all teachers, not just teachers of mathematics, need a sufficient amount of planning time built into the daily schedule to be effective teachers. (see recommendation #2)

PRIMARY DATA SOURCES

1. Glass, G.V., et al. Class size and learning: New interpretations of the research literature. Today's Education, 68 (2), 1979, pp. 42-44.
2. Suydam, M.N. & Weaver, J.F. Using Research: A Key to Elementary School Mathematics. Columbus, Ohio: ERIC, 1975.

3. Suydam, M.N. & Osborne, A. Status of Pre-College Science, Mathematics, and Social Science Education, 1955-1975, Vol. II Mathematics Education. The Ohio State University: ERIC, 1977.

4. MTF characteristics: 1.1C, 1.7S, 1.1T, 1.2T, 1.3T, 1.4C, 1.10S, 1.15S, 1.7C, 1.16S

5. MTF opinion.

NEED AREA: ORGANIZING FOR INSTRUCTION

NEED STATEMENT: THERE IS A NEED TO ORGANIZE MATHEMATICS CLASSROOMS FOR THE MOST EFFECTIVE INSTRUCTION.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Recommend to the West Virginia Board of Education that a resolution be adopted limiting class size in mathematics classes to 25 or fewer students.	1. Limit class size in mathematics classes to 25 or fewer students.	1. Limit class sizes in mathematics classes to 25 or fewer students.	
2. Mandate daily planning periods for all teachers.	2. Provide daily planning periods for all teachers.	2. Provide daily planning periods for all teachers.	
	3. Provide facilities and equipment that are adaptable to small group work and which facilitate the use of manipulative aids and activity-based learning experiences.	3. Provide facilities and equipment that are adaptable to small group work and which facilitate the use of manipulative aids and activity-based learning experiences.	
			4. Individualize instruction as necessary to meet the needs of students.
			5. Use flexible grouping to meet the needs of students.

NEED AREA PRIORITY

OVERVIEW

Since mathematics is the greatest need area with respect to student achievement in West Virginia, and since mathematics is identified as a top priority curriculum area in the document Educational Goals for West Virginia, a major effort must be instituted to make everyone aware of the needs in mathematics education in West Virginia. The recommendations in this section identify ways mathematics can be given top priority.

NEED STATEMENT

There is a need to operationalize the top priority status given to mathematics in the document Educational Goals for West Virginia (WVDE, 1975).

DATA SYNTHESIS

The top priority status given to mathematics by the West Virginia Board of Education and the unsatisfactory mathematics achievement profile provide the rationale for greater emphasis to be given to mathematics education in West Virginia. In the opinion of the MTF members, there are many actions that can be taken by the WVDE to increase the attention given to mathematics education. (see recommendations #1 and #2)

The MTF recognizes the need to educate the public on the nature and importance of mathematics. Furthermore, the MTF study gathered data showing that over 70% of the laypersons surveyed by the MTF want special programs concerning the nature and the importance of mathematics. (see recommendation #3) Also, the MTF felt that the public should be involved in efforts to give priority to mathematics. (see recommendation #4)

The MTF also felt there are several actions that can be taken by the WVDE to collect and disseminate information on the importance of the basic skill areas. (see recommendations #5, #6, and #7)

It was the opinion of the MTF that funds should be available to counties for improving mathematics education in West Virginia and that three specific sources of funding should be considered. (see recommendations #8, #9, and #10)

PRIMARY DATA SOURCES

1. West Virginia Department of Education, Educational Goals for West Virginia. Charleston, West Virginia: West Virginia Department of Education, 1975.
2. MTF characteristics: 11.2C, 11.1S, 11.3C, 11.2S.

NEED AREA: PRIORITY

NEED STATEMENT: THERE IS A NEED TO OPERATIONALIZE THE TOP PRIORITY STATUS GIVEN TO MATHEMATICS IN THE DOCUMENT EDUCATIONAL GOALS FOR WEST VIRGINIA (WVDE, 1975).

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Recommend that the West Virginia Board of Education adopt a resolution identifying the top priority status of mathematics. 1.1 Establish a rationale for the resolution which emphasizes mathematics as the greatest need area with respect to achievement. 1.2 Sponsor a joint proclamation by the Governor and the State Superintendent of Schools in support of the established State Board priority given to mathematics. 1.3 Publicize this priority to all educators and to the public. 1.4 Solicit the commitments of professional organizations for support of the proclamation. 1.5 Recommend that each county board of education adopt a resolution identifying the top priority status of mathematics.	1. Recommend that the county board of education adopt a resolution identifying the top priority status of mathematics.	1. Operationalize the county resolution identifying the top priority status of mathematics.	
2. Disseminate the findings and recommendations of the Mathematics Task Force to all mathematics educators in West Virginia, all county administrators, all professional organizations (e.g., West Virginia Elementary Principals Association, West Virginia Education Association), and other interested publics (e.g., West Virginia Congress of Parents and Teachers, the Legislative Subcommittee on Education).			

NEED AREA: PRIORITY

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
3. Communicate the nature of the mathematics program and the importance of mathematics through means such as radio; television; newspapers; and programs for civic groups, parent groups and professional organizations.	3. Communicate the nature of the mathematics program and the importance of mathematics through means such as radio; television; newspapers; newsletters; and programs for civic groups and parent groups.	3. Communicate the nature of the mathematics program and the importance of mathematics to students and the general public through means such as newsletters advisory groups, and parent-teacher groups.	3 Communicate the nature of the mathematics program and the importance of mathematics to students and the general public through means such as newsletters, advisory groups, and parent-teacher groups.
4. Develop strategies to involve the public in operationalizing the top priority status of mathematics.			
5. Establish a mathematics clearinghouse, coordinated through the office of the State Curriculum Development Specialist, Mathematics, which includes information on current issues in mathematics education, successful programs, resource persons, information on college preservice programs, literature, and research.			
6. Establish a Basic Skills (mathematics, reading, language arts) Annual Conference jointly planned by the West Virginia Department of Education, the West Virginia Mathematics Advisory Council, and the West Virginia Advisory Council on Reading.			
7. Publish a Basic Skills (mathematics, reading, language arts) Newsletter including information such as current research and federal programs.			
8. Identify mathematics as the area of greatest need when developing a plan for Title II programs and distribute funds accordingly.			

NEED AREA: PRIORITY

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
9. Solicit Title IV-C project proposals in mathematics, giving priority to the needs identified in the Mathematics Task Force Report. 10. Recommend to the State Legislature that Comprehensive Education Program funding be re-established.			

NEED AREA

PROGRAMS FOR HIGH-ABILITY STUDENTS

OVERVIEW

The MTF found data to suggest that mathematics achievement scores in West Virginia can be increased if attention is given to high-ability students in mathematics. Note that the term "high-ability" is used rather than "gifted." Although the mathematics program for gifted students in mathematics is a critical and often neglected area, the problem in mathematics education in West Virginia is much broader and inclusive. The major concern is the upper 25% of students in mathematics ability which would, of course, include the gifted students. Programs must be designed to ensure that these students are challenged to the best of their abilities.

NEED STATEMENT

There is a need to establish programs for high-ability students in mathematics at all grade levels.

DATA SYNTHESIS

Data from the West Virginia-State County Testing Program (SCTP) suggest that the needs of high-ability students in West Virginia are not being met. In particular, the table below shows that at each of grades 3, 6, 9, and 11, the percent of students scoring in the upper quarter of percentiles (i.e., 76th-99th percentiles) in mathematics is below the national norm. Also, the data show that the percent of students in the upper quarter declines as the grade level increases.

Table 10

Students in the Upper Quarter
1978-79

Grade	WV-Total Mathematics	National Norm
3	20%	25%
6	18%	25%
9	17%	25%
11	16%	25%

The MTF found that most schools do not have a mathematics program for their "most capable" students, excluding gifted students (28%, 53%, and 36% of the elementary, middle/junior high, and high schools, respectively, agree that they do have such programs). The MTF study also found that more high-gain schools than low-gain schools have programs for their most capable students in mathematics, excluding a gifted program.

The MTF study also found that a relatively small number of students are in gifted programs for mathematics (a mean of 0.4% of the students in grades 4-6 and 1.6% of the students in grades 7-8). At all grade levels, high-gain schools had a greater percentage of their students in a gifted program for mathematics than low-gain schools. Also, the National Science Foundation (NSF), in a study of mathematics education in the 1970's, concluded that "The needs of the gifted and talented are not being served in the 1970's" (NSF, 1979, p. 10).

Less than half of the teachers at any grade level believe they have sufficient enrichment materials (41%, 37%, and 33% of the elementary, middle/junior high, and high school teachers, respectively).

Finally, it was the opinion of the MTF that capable eighth grade students should have available to them an Algebra One course.

PRIMARY DATA SOURCES

1. National Science Foundation. Summary of Findings of Three NSF Sponsored Studies on the Status of Pre-College Science Education. Arlington, Virginia: American Association of School Administrators, 1979.
2. MTF characteristics: 5.4C, 5.4S, 5.12S, 6.4S.
3. MTF opinion.
4. Achievement data.

NEED AREA: PROGRAMS FOR HIGH ABILITY STUDENTS

NEED STATEMENT: THERE IS A NEED TO ESTABLISH PROGRAMS FOR HIGH-ABILITY STUDENTS IN MATHEMATICS AT ALL GRADE LEVELS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop models for: 1.1 identification of high-ability students in mathematics; 1.2 programs for high-ability students in mathematics.	1. Implement programs at all grade levels for high-ability students in mathematics. 1.1 Adopt a model for identifying high-ability students in mathematics. 1.2 Provide the appropriate quantity and quality of mathematics instructional materials and equipment for high-ability students in mathematics.	1. Implement programs at all grade levels for high-ability students in mathematics. 1.1 Identify high-ability students in mathematics. 1.2 Provide the appropriate quantity and quality of mathematics instructional materials and equipment for high-ability students in mathematics. 1.3 Offer Algebra One to capable eighth grade students.	1. Identify high-ability students in mathematics and provide activities to meet their needs.

NEED AREA REMEDIATION PROGRAMS

OVERVIEW

Remediation programs are for those students who are working on an achievement level below their ability level, regardless of how high or low that ability level may be. They are designed to help students match their achievement to their ability as quickly as possible.

Formal, structured remediation programs need to be included at every level. Early identification and remediation will lessen problems at higher grade levels. The goal should be to provide access to remediation services for every student who needs help.

NEED STATEMENT

There is a need to establish remediation programs at all levels.

DATA SYNTHESIS

The unsatisfactory mathematics achievement profile in West Virginia provides the rationale for more remediation programs. Furthermore, the MTF found strong agreement for establishing remedial mathematics programs at all grade levels (90%, 94%, and 88% of the elementary, middle/junior high, and high school teachers, respectively; 81% of the college persons; 93% of the superintendents; 92% of the supervisors ; and 87% of the laypersons). The MTF study also found that significantly more high-gain schools have remediation programs in grades 4 through 6 than low-gain schools. However, the MTF study also found that most teachers (41%, 32%, and 29% of the elementary, middle/junior high, and high school teachers, respectively) do not have the sufficient quantity and quality of remedial materials in their schools. (see recommendation #1)

The mathematics achievement scores on the State-County Testing Program have been lower than the reading achievement scores for several years. However, an analysis of the Title I services in the area of mathematics shows that there are relatively few Title I mathematics programs in West Virginia (Summary of ESEA Title I in West Virginia, 1979). (see recommendations #2 and #3)

Finally, the MTF was strongly in favor of the position that funded remediation programs are a necessity if competency testing programs were developed. (see recommendation #4)

PRIMARY DATA SOURCE

1. West Virginia Department of Education. Summary of ESEA Title I in West Virginia. Charleston, West Virginia: West Virginia Department of Education, 1979.

2. MTF characteristics: 2.7S, 5.6S, 6.2S, 12.10.
3. MTF opinion.
4. Achievement data.

NEED AREA: REMEDIATION PROGRAMS

NEED STATEMENT: THERE IS A NEED TO ESTABLISH REMEDIATION PROGRAMS AT ALL LEVELS.

DEPARTMENT OF EDUCATION	COUNTY	SCHOOL/PRINCIPAL	CLASSROOM/TEACHER
1. Develop models for:	1. Implement remediation programs at all grade levels.	1. Implement remediation programs at all grade levels.	1. Identify students who need remediation in mathematics and provide instructional activities to meet their needs.
1.1 identification of students who need remediation in mathematics;	1.1 Adopt a model for identifying students who need remediation in mathematics.	1.1 Identify students who need remediation in mathematics.	
1.2 remediation programs in mathematics.	1.2 Coordinate all remedial instruction with the basal program.	1.2 Coordinate all remedial instruction with the basal program.	
	1.3 Limit class size to 15 for remedial classes.	1.3 Limit class size to 15 for remedial classes.	
	1.4 Provide the appropriate quantity and quality of instructional materials and equipment for both special remediation programs and for regular classroom teachers.	1.4 Provide the appropriate quantity and quality of instructional materials and equipment for both special remediation programs and for regular classroom teachers.	
2. Implement E.S.E.A. Title I mathematics programs at all grade levels based on county needs as shown by achievement scores.			
3. Enforce certification requirements for all remedial mathematics teachers, including E.S.E.A. Title I mathematics teachers.			
4. Fund remediation programs in mathematics if State competency testing is implemented.	4. Fund remediation programs in mathematics if county competency testing is implemented.		

NEED AREA TEACHER EDUCATION

OVERVIEW

Many of the recommendations in this report are directly concerned with specific skills related to the teaching of mathematics - skills which certainly have some effect on student achievement. Furthermore, most people agree that a primary goal of mathematics teachers education programs is to develop these skills in prospective teachers of mathematics. In West Virginia, the Standards for Approval of Teacher Education Programs provide direction for mathematics teacher training experiences. Most of the recommendations in this section provide specific guidelines for revising the existing Standards with respect to the mathematics content and methods requirements for prospective teachers, a process for evaluating teacher education programs, and certification areas related to mathematics.

NEED STATEMENT

There is a need to revise mathematics teacher education programs in West Virginia.

DATA SYNTHESIS

There is agreement among mathematics educators that the instructional practices, behaviors, and attitudes exhibited by teachers related to mathematics can to a great extent be influenced by teacher education experiences. Furthermore, research in mathematics education is beginning to search for effective mathematics teacher education practices and the results thus far are promising (see e.g., Thornton, 1977).

There are no doubt many characteristics of successful mathematics teacher education programs, and it is surely possible that many different types of training experiences may be equally effective in producing competent teachers of mathematics. However, one characteristic of any successful program is that the experiences gained in the program meet the needs of the participants. The MTF study found that several topics need more emphasis in teacher education programs in West Virginia (see attached table and recommendation #9).

Although the table identifies topics West Virginia teachers believe need more emphasis in teacher education programs, this list is not intended to be a prescription for goals and objectives of mathematics teacher education. Several groups have, however, attempted to do this. Two, in particular, deserve consideration: (1) Guidelines for the Preparation of Teachers of Mathematics (NCTM, 1979) and (2) Mathematics Methods Conference (University of Northern Iowa & Central States University, Inc., 1978). (see recommendations #2 and #9)

In West Virginia, the Standards for Approval of Teacher Education Programs set forth guidelines for mathematics teacher education. The MTF study found that 86% of the responding college chairpersons (6 out of 7) felt there is a need to review and revise the Standards. Also, the MTF gathered data to suggest several specific changes in the Standards. In particular the MTF study found that: (a) most people (60% of the elementary, 68% of the middle/junior high, and 72% of the high school teachers; 71% of the superintendents; 92% of the supervisors; and 90% of the college persons) agree that teacher education programs should have competency in arithmetic as an entrance requirement and (b) elementary teachers agree that preservice teachers should have the opportunity to work in classrooms early in their program (79% agree). (see recommendation #3)

Any effort to identify goals and objectives of mathematics teacher education must conside the state of the art of research on teacher effectiveness. Even though research on teacher effectiveness has been done for over 100 years, there is lettle evidence concerning which behaviors have consistent effects on student achievement (see e.g., Dukin & Biddle, 1974; Cooney, 1976; and Medley, 1977). However, much of this research is marred by serious methodological weaknesses. Current advances in research design and statistical analysis may indeed open a new era in teacher effectiveness research. At the present time, however, there is no empirical support for basing teacher education programs nor certification procedures solely on competency or performance-based criteria (see NACOME, p. 140).

The MTF recognized the lack of empirical support for basing teacher certification solely on competency or performance-based testing, but they did recognize the need for institutions of higher education to be more accountable for their programs. (see recommendation #4)

The MTF felt that there were several changes needed in teacher education in West Virginia in addition to those noted above. New certification requirements were identified, and new certification areas (i.e., mathematics specialists) were considered essential. (see recommendations #3, #7, and #8)

The serious shortage of well-qualified mathematics teachers prompted the MTF to generate two recommendations related to the certification of teachers in general and, in particular, the certification of mathematics teachers. (see recommendations #5 and #6)

Finally, it was the consensus of the MTF that mathematics educators should play a major role in all efforts that will affect mathematics teacher education in West Virginia. (see recommendations #1 and #2)

PRIMARY DATA SOURCES

1. Thornton, C.A. An Evaluation of the Mathematics-Methods Program Involving the Study of Teaching Characteristics and Pupil Achievement in Mathematics, Journal for Research in Mathematics Education, 8 (1), 1977, pp. 17-25.

2. National Council of Teachers of Mathematics. Guidelines for the Preparation of Teachers of Mathematics. Reston, Virginia: NCTM, 1979.

3. Rathmell, E.C. (Ed.), Proceedings of the Mathematics Methods Conference. Cedar Fall, Iowa: University of Northern Iowa and Central States Universities, Inc., 1978.

4. Dunkin, J.J. & Biddle, B.J. The Study of Teaching. New York: Holt, Rinehart, & Winston, 1974.

5. Cooney, T.J. (Ed.), Teaching Strategies: Papers from a Research Workshop. Athens, Georgia: The Georgia Center for the Study of Learning and Teaching Mathematics, 1976.

6. Medley, D.M. Teacher Competence and Teacher Effectiveness: A Review of Process-Product Research. A paper prepared to AACTE Committee on Performance-Based Teacher Education, 1977.

7. Conference Board of the Mathematical Sciences and the National Advisory Committee on Mathematics Education (NACOME). Overview and Analysis of School Mathematics K-12. Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

8. MTF characteristics: 12.5, 13.1, 13.2, 13.3, 9.6T.

Table II

Percent of Teachers Wanting More Emphasis, the Same Emphasis, or Less Emphasis on Selected Mathematics Content and Methods Topics in Teacher Education Programs

	More Emphasis					Same Emphasis					Less Emphasis				
	E[a]	M	H	S	C	E	M	H	S	C	E	M	H	S	C
Content:															
Algebra	25[b]	44	51	54	52	57	52	48	45	48	18	0	0	0	0
Applications	75	80	80	100	100	20	16	12	0	7	0	0	0	0	0
Calculators	30	46	48	75	55	40	35	43	25	28	20	18	9	0	16
Calculus	13	16	38	17	25	58	65	52	75	46	27	18	9	8	28
Computer Literacy	30	48	70	83	82	50	40	23	16	9	20	11	5	0	7
Geometry	27	40	48	50	51	56	56	48	50	48	16	0	0	0	0
Measurement	61	61	54	75	53	37	33	43	25	37	0	0	0	0	0
Probability & Statistics	21	35	54	64	79	58	59	43	17	16	20	6	5	8	5
Problem Solving	80	80	80	100	97	20	15	18	0	3	0	0	0	0	0
Proof/Reasoning	58	57	55	75	63	35	38	40	25	32	7	0	0	0	0
Structure	40	45	53	50	52	53	49	50	42	43	6	5	6	8	0
Methods:															
Audio-visual	61	63	52	75	42	34	34	45	25	44	5	4	3	0	19
Careers	51	75	74	82	67	47	23	24	17	35	2	3	2	0	0
Concepts	78	85	82	92	77	21	15	20	8	19	1	0	0	0	5
Diagnosis/Remediation	69	76	70	92	65	30	23	38	8	33	2	1	2	0	2
Evaluating Materials	61	61	44	68	49	35	36	43	42	40	3	4	3	0	12
Evaluation	65	68	66	92	61	34	30	33	8	37	1	1	1	0	2
Grouping	68	78	70	92	49	30	20	29	8	47	2	2	0	0	5
Learning Math	78	79	76	92	68	21	21	24	8	23	1	1	1	0	9
Long-range Planning	76	64	58	92	54	39	34	39	8	35	3	3	4	0	12
Management Strategies	67	71	64	88	48	32	27	34	17	42	1	2	2	0	9
Mainsteaming	49	44	42	83	28	37	36	42	8	54	14	20	16	8	19
Manipulatives	69	65	56	92	42	28	32	44	8	50	2	3	1	0	9
Non-college Bound	68	84	79	92	65	29	16	20	8	33	3	1	0	0	2
Problem Solving	82	87	80	100	93	17	13	19	0	7	1	0	1	0	0
Reading in Math	65	75	65	92	79	30	23	33	8	21	6	2	2	0	0

[a] E - elementary school teachers
M - middle/junior high school teachers
H - high school teachers
S - supervisors
C - college persons

[b] Percents are rounded to the nearest whole number.

NEED AREA: TEACHER EDUCATION

NEED STATEMENT: THERE IS A NEED TO REVISE MATHEMATICS TEACHER EDUCATION PROGRAMS IN WEST VIRGINIA.

DEPARTMENT OF EDUCATION

1. Include at least one mathematics educator on the West Virginia Advisory Council on the Professional Development of Educational Personnel.

2. Revise the Standards for the Approval of Teacher Education Programs in West Virginia.

   2.1 Give mathematics educators the major responsibility for developing mathematics competencies in all areas.

   2.2 Consider the recommendations of the Mathematics Task Force concerning topics needing more emphasis in teacher education programs when developing mathematics content and methods competencies (see recommendation #9 below).

3. Revise the Standards for the Approval of Teacher Education Programs in West Virginia to reflect the following teacher education requirements.

   3.1 Include in each teaching specialization (e.g., social studies, science) competencies related to applications of mathematics in that area.

   3.2 Include a requirement that each prospective teacher at all levels have maximum opportunities for observations and other field experiences early in the teacher education program.

   3.3 Include the requirements that each institution of higher education include competency in arithmetic for prospective teachers and provide a remedial mathematics program for those who fail the competency requirement.

   3.4 For all teachers of mathematics in grades K-12, include competencies concerning the teaching and learning of mathematics in grades K-12 (competencies equivalent to 2-4 semester hours).

   3.5 In addition to the general requirement identified in 3.4 include the following for prospective teachers of mathematics:

      3.5.1 For teachers in grades K-4 include competencies concerning methods of teaching mathematics in early childhood settings (competencies equivalent to 2-4 semester hours) and mathematical content competencies (equivalent to 6 semester hours).

      3.5.2 For teachers in grades 5 and 6 include competencies concerning methods of teaching mathematics in middle childhood education settings (competencies equivalent to 2-4 semester hours) and mathematics content competencies (equivalent to 9 semester hours).

      3.5.3 For teachers in grades 7 and 8 include competencies concerning methods of teaching mathematics in middle childhood education settings (competencies equivalent to 2-4 semester hours) and mathematical content competencies (equivalent to 15 semester hours).

      3.5.4 For teachers in grades 9-12 include competencies specifically concerned with teaching "general" mathematics courses and specifically concerned with teaching "academic" mathematics courses (competencies equivalent in 2-4 semester hours - see recommendations 2 and 3 in Adolescent Education p. 22) and mathematical content competencies (equivalent to 27 semester hours).

4. Revise the Standards for Approval of Teacher Education Programs in West Virginia to include a process for evaluating mathematics teacher education programs.

   4.1 Require each institution of higher education (IHE) to develop its own mathematics teacher education assessment plan for the purpose of program evaluation.

   4.2 Require each IHE to base its mathematics teacher education assessment plan on the competencies included in the "Revised Standards for Approval of Teacher Education Programs in West Virginia."

   4.3 Include the requirement that a sample of mathematics teachers be assessed with respect to their attainment of specific competencies for the purpose of program evaluation, not for determining individual teacher certification.

   4.4 Require each IHE to report its findings to the West Virginia Department of Education.

   4.5 Identify the mathematics specialist on the Teacher Education Program Approval visitation team as the one responsible for validating mathematics competencies at all levels (e.g., early childhood).

DEPARTMENT OF EDUCATION

5. Maintain and disseminate data on the supply and demand of teachers by certification area.

6. Establish a single field secondary mathematics certification in addition to existing options.

7. Establish a K-8 Mathematics Specialist certification at the graduate level with competencies in the areas of diagnosis and remediation, development of, and instruction in remedial and enrichment programs, and mathematics curriculum development and evaluation, (see recommendation #5 in Organizational Network p. 70).

8. Establish a 9-12 Mathematics Specialist certification at the graduate level with competencies in the areas of diagnosis and remediation, development of and instruction in remedial and enrichment programs, and mathematics curriculum development and evaluation and with mathematical content competencies equivalent to a bachelor's degree in mathematics. (see recommendation #5 in Organizational Network p. 70).

9. Encourage colleges to provide more emphasis on the following mathematical content and methods topics in teacher education programs.

    9.1 For teachers at all levels, more emphasis is needed in the following content areas:

        9.1.1 applications
        9.1.2 problem solving
        9.1.3 measurement
        9.1.4 logical reasoning

    9.2 For teachers at the adolescent education level, more emphasis is needed in the following content areas:

        9.2.1 computer literacy
        9.2.2 algebra
        9.2.3 probability and statistics

    9.3 For teachers at all levels, more emphasis is needed in the following areas concerned with methods of teaching mathematics:

        9.3.1 reading in mathematics
        9.3.2 pupil evaluation in mathematics
        9.3.3 how children learn mathematics
        9.3.4 classroom management and discipline
        9.3.5 strategies for teaching mathematical concepts
        9.3.6 strategies for teaching the non-college bound student
        9.3.7 grouping for mathematics instruction
        9.3.8 diagnosis and remediation
        9.3.9 manipulative aids

NEED AREA: TEACHER EDUCATION

DEPARTMENT OF EDUCATION

9.3.10 evaluating instructional materials

9.3.11 using audio-visual aids in teaching mathematics

9.3.12 long-range planning for mathematics

9.3.13 careers related to mathematics

CHAPTER IV

SUMMARY AND CONCLUSIONS

Review of the Study

The top priority status given to mathematics in the document Educational Goals for West Virginia and the unsatisfactory mathematics achievement profile prompted the West Virginia Department of Education to commission a Mathematics Task Force (MTF) in April, 1979. The purposes of the MTF were to conduct a study of mathematics education in West Virginia and, subsequently, to make recommendations for improving mathematics education in the State.

The MTF was composed of 22 people from a variety of geographical and occupational areas in West Virginia. Teachers, guidance counselors, special educators, principals, mathematics supervisors, superintendents, college mathematics educators, and the laypublic were represented on the MTF. Thus, the validity of the work of the MTF was ensured by the variety of groups represented on the Task Force.

To formulate recommendations, the MTF collected three types of data: (1) literature and research related to mathematics education; (2) opinions of the members of the MTF; and (3) data from a survey conducted by the MTF. The MTF survey involved 13 mathematics supervisors in West Virginia, 40 county superintendents, 43 college mathematics educators, 67 members of the West Virginia Congress of Parents and Teachers, and over 3500 teachers and principals throughout West Virginia. An analysis of the data enabled the MTF to formulate 64 major recommendations to the West Virginia Department of Education in 15 need areas. The titles of these need areas are:

1. Adolescent Education
2. Affective Domain
3. Basic Skills in Mathematics
4. Continuing Education
5. Curriculum Development and Evaluation
6. Instructional Materials
7. Instructional Practices
8. Instructional Time
9. Mathematics Teachers
10. Organizational Network
11. Organizing for Instruction
12. Priority
13. Programs for High-Ability Students
14. Remediation Programs
15. Teacher Education

Implementation of the Recommendations

The specific charge of the MTF was to formulate recommendations for improving mathematics education in West Virginia. In the process of generating recommendations, two questions concerning the role of the MTF in developing a plan for the implementation of the recommendations were considered.

(1) To what extent should the MTF consider the difficulty of implementing particular recommendations?

(2) Should the MTF prioritize the recommendations?

There were several occasions in the process of formulating recommendations that the MTF considered issues related to the difficulty of implementing particular recommendations. The MTF resolved these issues by returning to its commission, namely, to make recommendations for improving mathematics education. In particular, the MTF decided that its commission was not to only make those recommendations for improving mathematics education which were economically feasible at this time, easily implemented from an administrative point of view, or consistent with current practice and trends in West Virginia.

The data collected by the MTF clearly show a need to improve mathematics education in West Virginia. Futhermore, data collected by the MTF show that mathematics education in West Virginia has been in serious need of attention for several years. Therefore, it was the opinion cf the MTF that all of the recommendations in this report are "top" priority. However, the MTF recommends that an initial step in a State plan for improving mathematics achievement be the implementation of the recommendations in two particular need areas, "basic skills in mathematics" and "priority."

The implementation of many of the recommendations in this report can only be successful if a common understanding exists relative to basic skills in mathematics. Because data collected by the MTF suggest that many people in West Virginia equate mathematics with computational skills alone, an initial step in a State plan for improving mathematics education must be the development and dissemination of a definition for basic skills in mathematics. Recommendation number one (see p.31) in the need area "basic skills in mathematics" provides the foundation for the development of a definition.

In the opinion of the MTF, the resolution by the West Virginia Board of Education in 1975, identifying reading as the top priority in this State, had a tremendous impact on the teaching of reading. In fact, many educators erroneously inferred from that resolution that reading is the most important subject in the public schools. The second component of the initial step in a State plan for improving mathematics education should be the implementation of recommendation number one (see p. 80) in the need area entitled "priority." This recommendation is concerned with a resolution by the West Virginia Board of Education identifying the top priority status of mathematics. Indeed, the challenge of the West Virginia Department of Education is to demonstrate to every educator, student, and layperson in the State the top priority status of mathematics in West Virginia and to operationalize that top priority through its actions in the 1980's.

Conclusion

Improving mathematics education in the State of West Virginia is a challenge to everyone. Further, to effect change in mathematics education, commitments from educators and the public at the State and local levels is essential. The work of the Mathematics Task Force is an important yet small beginning in the process of improving mathematics education in this State. The West Virginia Department of Education now has the opportunity to be a leader among states in improving the mathematics education of its children.

APPENDIX A

Student Achievement in Mathematics

An analysis of data from the 1978-79 State-County Testing Program (Figure 1) shows that mathematics scores rank lowest of all the subject areas tested at grades three, six, nine, and eleven. These data also indicate a steady decline in mathematics achievement scores across grade levels.

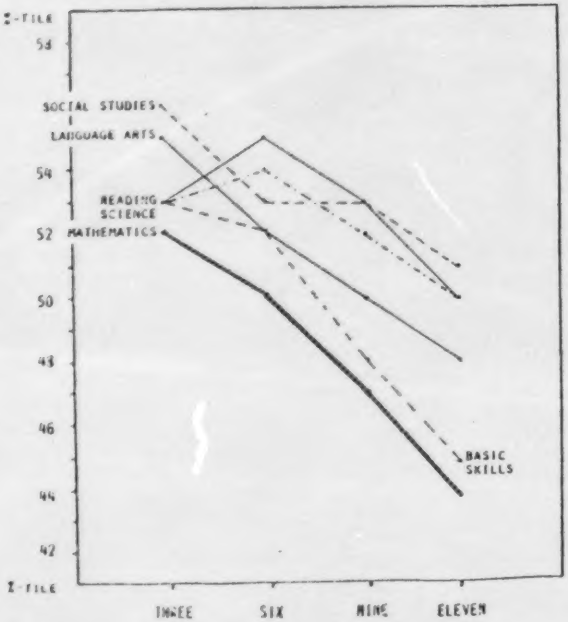


Figure 1: CTBS State Results 1978-79

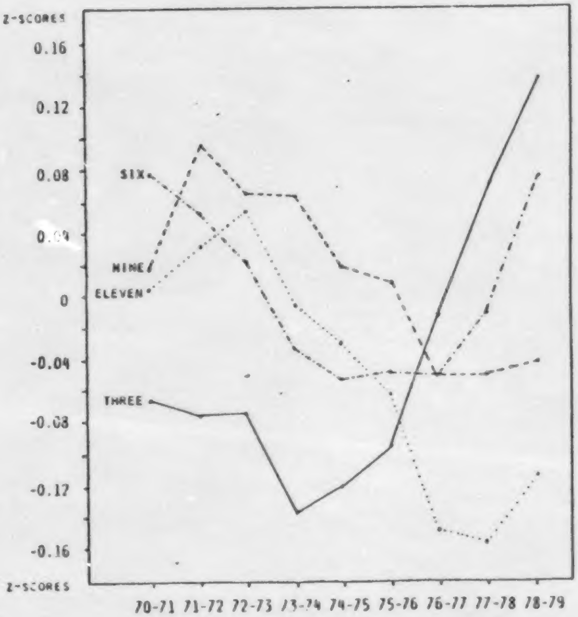


Figure 2: Mathematics State Results 1970-79

Results of the study of the mathematics state-county test data for the academic years 1970-71 through 1978-79 (Figure 2) indicate a major decline in past years and a rise in more recent years. Scores dropped for grades six, nine, and eleven from 1972-73 through 1976-77. This declining trend in scores has reversed with the 1977-78 and 1978-79 scores. Although these scores are increasing, they are still below the national norm for grades nine and eleven.

Each year approximately forty percent of West Virginia's high school seniors take the American College Test (ACT), a much larger number of students than those who take the Scholastic Aptitude Test (SAT). A comparison of the test results over the last ten years (Figure 3) indicate that the mean scores for West Virginia are consistently below the national means. In six of the ten years, including the last three years, the State's mathematics scores have been farther below the national means than any other subject area measured.

YEAR	ENGLISH		MATH		SOCIAL STUDIES		NATURAL SCIENCE	
	W.V.	Nat.	W.V.	Nat.	W.V.	Nat.	W.V.	Nat.
1969-70	18.5	18.1	19.3	19.5	19.2	19.3	20.6	20.5
1970-71	18.0	17.7	18.2	18.7	18.2	18.3	20.4	20.2
1971-72	17.9	17.6	18.1	18.6	18.3	18.4	20.4	20.3
1972.73	18.1	17.8	18.3	18.8	18.0	18.1	20.5	20.5
1973-74	18.0	17.9	17.3	18.3	17.8	18.1	20.7	20.8
1974-75	17.7	17.7	16.5	17.6	17.0	17.4	20.8	21.1
1975-76	17.4	17.5	16.2	17.5	16.2	17.0	20.4	20.8
1976-77	17.5	17.7	15.9	17.4	16.5	17.3	20.5	20.9
1977-78	17.5	17.9	15.5	17.5	16.0	17.1	20.3	21.9
1978-79	17.7	17.9	15.9	17.5	16.3	17.2	20.6	21.1

Figure 3: Comparison of West Virginia and National ACT Scores

1969-70 through 1978-79

APPENDIX B

Membership of the Mathematics Task Force

Procedure for the Selection of Members

The task force was composed of teachers, a counselor, a special educator, principals, mathematics supervisors, a superintendent, college instructors, and a layperson. These individuals came from various counties and regions. They also represented several organizations including the West Virginia Council of Teachers of Mathematics, the West Virginia Board of Regents, and West Virginia Congress of Parents and Teachers.

The State Curriculum Development Specialist, Mathematics chose the task force co-chairmen. He then worked closely with them and other individuals from the Department of Education in choosing the remaining task force members. The co-chairmen also worked with the Curriculum Development Specialist, Mathematics in the choice of the writing team and in the administration of the task force. The writing team was the primary writing body of the task force with the entire task force serving as generators of ideas, providers of data, and critics of written work. The executive committee consisted of the Task Force co-chairmen.

Membership List

Ernestine Capehart
Teacher
Dunbar High School

**Randall Charles
Mathematics Supervisor
Wood County Schools

*Daniel Curry
Principal
Marlinton Elementary School

*Margaret Deadrick
Teacher
Miller Junior High School

Patricia Debold
Teacher
Glen Dale Elementary School

Bobbie Fisher
Counselor
Ripley High School

Elizabeth Frye
Instructor
Fairmont State College

Larry Gainer
Superintendent
Pleasants County Schools

*Sandra Giuliani
Mathematics Supervisor
Harrison County Schools

Jean Hall
Mathematics Supervisor
Kanawha County Schools

*Kathy Hicks
Teacher
West Virginia Wesleyan College

*Boyd Holtan
Professor
West Virginia University

Donna Landin
Teacher
Duval High School

*Dolores LeMaster
Mathematics Supervisor
Cabell County Schools

**Robert Mason
Assistant Director of Curriculum
Mineral County Schools

Donald McCann
Principal
Harts High School

Dave McChesney
Special Education Director
Braxton County Schools

Joan Hofsinger
Teacher
Keyser Middle School

*Barbara Olcott
Teacher
St. Joseph Preparatory Seminary

I. D. Peters
Department Chairman
West Virginia University

Arthur Swarthout
Layman
Scott Depot

Kevin Williams
Mathematics Supervisor
RESA V

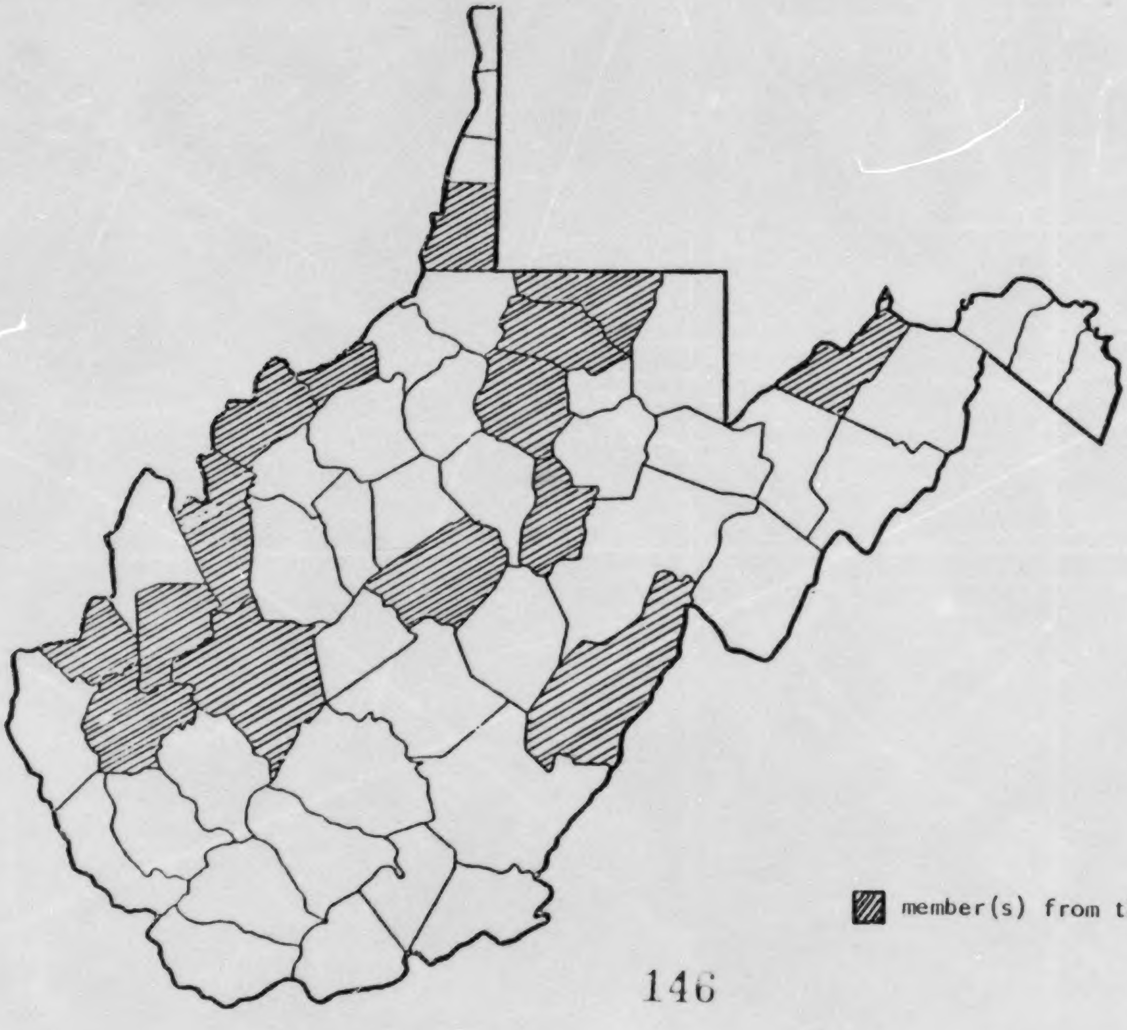
*Writing Team Member
**Co-chairman

Representation Matrix

	Superintendent	Principal	Teacher	Supervisor	College Instructor	WVCTM[a] Officer	Regents Liason	Layman	Counselor	Special Educator
Ernestine Capehart			X			X				
Randall Charles				X						
Daniel Curry		X								
Margaret Deadrick			X			X				
Patricia Debold			X							
Bobbie Fisher									X	
Elizabeth Frye					X					
Larry Gainer	X									
Sandra Giuliani				X						
Jean Hall				X						
Kathy Hicks			X							
Boyd Holtan					X	X				
Donna Landin			X							
Dolores LeMaster				X						
Robert Mason				X		X				
Donald McCann		X								
Dave McChesney				X						X
Joan Nofsinger			X			X				
Barbara Olcott			X							
I. D. Peters					X		X			
Arthur Swarthout								X		
Kevin Williams				X						

[a] West Virginia Council of Teachers of Mathematics

Geographic Distribution



▨ member(s) from the county

APPENDIX C

Chronology of Events

March 7-9, 1979 (Morgantown)
MTF Executive Committee Meeting
Plan for organization and selection of task force

March 28-29, 1979 (Princeton)
MTF Executive Committee Meeting
Plan first meeting

April 4-6, 1979 (Charleston)
MTF Meeting
Generate characteristics affecting mathematics achievement

April 6-7, 1979 (Charleston)
MTF Writing Team Meeting
Refine characteristics affecting mathematics achievement

April 23, 1979 (Parkersburg)
MTF Executive Committee Meeting
Plan data collection

April 29 - May 1, 1979 (Fairmont)
MTF Writing Team Meeting
Develop survey instruments

June 4-5, 1979 (Charleston)
MTF Executive Committee Meeting
Finalize data analysis procedure

June 24-27, 1979 (Canaan Valley)
MTF Executive Committee Meeting
Begin draft of components of report

July 10-11, 1979 (Charleston)
MTF Meeting
Update format for recommendations

July 11, 1979 (Charleston)
MTF Writing Team
Plan format for recommendations

July 23-26, 1979 (Charleston)
MTF Writing Team Meeting
Condense preliminary data

August 6-8, 1979 (Charleston)
MTF Meeting
React to preliminary data

August 8, 1979 (Charleston)
MTF Writing Team Meeting
Refine reactions to preliminary data

October 3-6, 1979 (Buckhannon)
MTF Writing Team Meeting
Develop findings, discrepancies, and needs

October 24-27, 1979 (Grafton)
MTF Meeting
Draft recommendations

December 6-8, 1979 (Charleston)
MTF Executive Committee Meeting
Refine recommendations

January 16, 1980 (Fairmont)
MTF Executive Committee Meeting
Draft final report

February 14, 1980 (Bridgeport)
MTF Meeting
React to draft of final report

February 15, 1980 (Bridgeport)
MTF Executive Committee Meeting
Complete final report

APPENDIX D

Sample Survey Forms

FORM A[a]

Mathematics
Task Force
Study
1979

West Virginia Department of Education

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[a] Completed by elementary teachers.

BACKGROUND INFORMATION

Indicate the category that best applies to you. Mark only one response for each item on the mark sense answer sheet.

1. Job description:

    a. Teacher
    b. Special Education Teacher
    c. Special Program Teacher
    d. Counselor
    e. Other

2. Sex:

    a. Female
    b. Male

3. Age:

    a. 24 or less
    b. 25-29
    c. 30-39
    d. 40-54
    e. 55 or more

4. Years of teaching experience including this year:

    a. 1
    b. 2-3
    c. 4-10
    d. 11-20
    e. over 20

5. Years of teaching experience in the school to which you are currently assigned:

    a. 1
    b. 2-3
    c. 4-10
    d. 11-20
    e. over 20

6. Undergraduate semester hours of mathematics content completed:

    a. 0
    b. 1-3
    c. 4-6
    d. 7-9
    e. over 9

7. Undergraduate semester hours of mathematics methods completed:

   a. 0
   b. 1-3
   c. 4-6
   d. 7-9
   e. over 9

8. Graduate semester hours completed in all areas:

   a. 0
   b. 1-6
   c. 7-15
   d. 16-30
   e. over 30

9. Graduate semester hours of mathematics content completed:

   a. 0
   b. 1-3
   c. 4-6
   d. 7-9
   e. over 9

10. Graduate semester hours of mathematics methods completed:

    a. 0
    b. 1-3
    c. 4-6
    d. 7-9
    e. over 9

11. Years since you have taken a mathematics content and/or methods course, not including in-service education:

    a. less than 1 year
    b. 1-2
    c. 3-5
    d. 6-10
    e. over 10

12. Your West Virginia salary classification level:

    a. bachelor's
    b. bachelor's + 15
    c. master's
    d. master's + 15
    e. master's + 30 or above

13. Your West Virginia certification:

    a. elementary with early childhood specialization
    b. elementary without mathematics specialization
    c. 4-8 mathematics specialization
    d. 7-9 mathematics specialization
    e. 7-12 mathematics specialization

14. Total hours of in-service education in all areas you participated in this school year:

    a. 0
    b. 1-3
    c. 4-10
    d. 11-15
    e. over 15

15. Total hours of in-service education specifically related to teaching mathematics you participated in this year:

    a. 0
    b. 1-3
    c. 4-10
    d. 11-15
    e. over 15

16. Your classroom teaching assignment:

    a. Single grade self-contained
    b. Split grade self-contained
    c. Departmentalized
    d. Other

17. Your grade level responsibility (mark more than one response if you teach multiple grades):

    a. K
    b. 1-2
    c. 3
    d. 4
    e. none of these

18. Your grade level responsibility continued (mark more than one if you teach multiple grades):

    a. 5
    b. 6
    c. 7
    d. 8
    e. none of these

OPINIONNAIRE

Below is a list of statements concerned with mathematics education. Read each statement and respond using the following scale.

a. I strongly agree.
b. I tend to agree.
c. Neutral
d. I tend to disagree.
e. I strongly disagree.

There are no right or wrong responses to these statements. Be sure to mark only one response to each statement on the mark sense answer sheet.

19. A planned communication between mathematics teachers and counselors should exist.

20. County systems should reward teachers who serve in mathematics education leadership roles.

21. A student's progress to a new mathematics topic should depend on complete mastery of the current topic.

22. The relationship of mathematics to other disciplines should be emphasized.

23. The importance of mathematics should be communicated to the public through special programs.

24. Students should be required to pass a mathematics competency examination for grade level promotion.

25. The metric system should be given more emphasis in the mathematics program.

26. Pre-service teachers should have the opportunity to work in classrooms early in their program.

27. Practice tests related to the State-County Testing program should be available to all teachers in grades 3, 6, 9 and 11.

28. Students should be grouped homogenously for mathematics instruction.

29. The mathematics instructional program should be departmentalized above grade three.

30. The mathematics instructional program should be based on a diagnostic/prescriptive approach.

31. Each Regional Education Service Agency (RESA) should employ a mathematics specialist.

32. The mathematics curriculum should spiral within and across grade levels.

33. Basic skills in mathematics should be defined as addition, subtraction, multiplication and division of whole numbers, fractions and decimals.

34. Teachers should be actively involved in professional mathematics teacher organizations.

35. Graphing experiences should be given more emphasis in the mathematics program.

36. Pre-service teacher education programs should have competency in arithmetic as an entrance requirement.

37. Decimals should be given more emphasis in the mathematics program.

38. Topics in geometry should not be taught before the 7th grade.

39. Teachers of subjects other than mathematics should participate in in-service education programs concerned with applications of mathematics within their fields.

40. Teachers of mathematics should utilize peer teaching by students.

PROGRAM DESCRIPTION

Below is a list of statements concerned with the mathematics program in your school. Read each statement and respond using the following scale.

a. I strongly agree.
b. I agree somewhat.
c. Neutral
d. I disagree somewhat.
e. I strongly disagree.

There are no right or wrong responses to these statements. Be sure to mark only one response to each statement on the mark sense answer sheet.

41. Teachers in my school emphasize the fact that mathematics is a subject for females as much as it is for males.

42. The amount of available graduate study in mathematics education is sufficient to meet the needs of the teachers in my school.

43. Appropriate mathematics instructional materials are available for special education students, including gifted students.

44. Teachers in my school regularly observe others teaching mathematics.

45. My school's mathematics program is based on a diagnostic/prescriptive approach.

46. Students in my school have a positive self-image with respect to success in mathematics.

47. The mathematics program at my school is continuous across grade levels.

48. The quantity and quality of mathematics enrichment materials available at my school are sufficient to meet the needs of the students.

49. Professional literature related to teaching mathematics is readily available.

50. The relationship of mathematics to other disciplines is emphasized in my school.

51. Teachers at my school make mathematics an exciting and challenging subject.

52. Evaluation of student performance includes a variety of assessment techniques such as assigned work, observation, questioning and written tests.

53. Teachers in my school have an excellent inventory of available mathematics materials.

54. Teachers at my school use a variety of instructional methods and materials to meet individual learning styles.

INSTRUCTIONAL PRACTICES

Indicate the extent to which each of the following is used in your mathematics classes. Read each phrase and indicate the response from the following scale which best describes your situation.

a. About daily.
b. About once a week.
c. About once a month.
d. About once a year.
e. Never

There are no right or wrong responses to these items. Be sure to mark only one response for each item on the mark sense answer sheet.

55. Mathematical games

56. Hand-held calculators

57. Mental or oral computation

58. Estimating computations

59. Estimating measurements

60. Manipulative aids

61. Problem solving (word problems, logical reasoning, etc.)

62. Applications of mathematics

63. Life skills (banking, cooking, buying, etc.)

64. Uses of mathematics in various careers

65. Worksheets

66. Workbooks

67. Supplementary materials other than those provided with the basal text series

68. Activities outside the classroom (e.g., outdoor mathematics)

69. Community resources (e.g., speakers)

70. Field trips

71. Films and filmstrips

72. Instructional television

73. Overhead projector

74. Other media (e.g., cassettes, magazines)

75. Computer literacy

76. Practice/drill

77. Review of topics students have not seen for sometime (e.g., one month)

78. Homework

79. Basal text

80. Chalkboard work by students

81. Bulletin board for mathematics

IN-SERVICE EDUCATION

Below are several topics related to mathematics content and the teaching of mathematics that could receive more or less emphasis in in-service teacher education programs. Read each topic and respond using the following scale.

a. should receive much more emphasis
b. should receive somewhat more emphasis
c. should receive about the same emphasis as now
d. should receive somewhat less emphasis
e. should receive much less emphasis

There are no right or wrong responses to these statements. Be sure to mark only one response to each statement on the mark sense answer sheet.

Topics Related to Mathematics Content

82. applications of mathematics

83. problem solving

84. computer literacy

85. structure of mathematics

86. measurement

87. proof and logical reasoning

88. calculators

89. algebra

90. geometry

91. probability and statistics

92. calculus

Topics Related to the Teaching of Mathematics

93. reading in mathematics

94. evaluation of student achievement

95. how children learn mathematics

96. classroom management and discipline

97. strategies for teaching specific mathematics concepts

98. teaching problem solving

99. teaching non-college bound students

100. grouping students for mathematics instruction
101. diagnosis and prescription
102. using manipulative aids
103. mainstreaming in the mathematics classroom
104. evaluating instructional materials
105. using audiovisual materials
106. long-range planning
107. mathematics and careers

COMPLETE THIS PAGE IN THE SPACE PROVIDED, DETACH AND RETURN IT AND THE MARK SENSE ANSWER SHEET TO YOUR PRINCIPAL

QUESTIONNAIRE

1. In your opinion, what are the 3 greatest strengths of the mathematics program in your school?

   1)

   2)

   3)

2. In your opinion, what are the 3 greatest needs of the mathematics program in your school?

   1)

   2)

   3)

3. What specific recommendations would you make to improve the mathematics program in West Virginia?

COMPLETE THIS PAGE IN THE SPACE PROVIDED, DETACH AND RETURN IT AND THE MARK SENSE ANSWER SHEET TO YOUR PRINCIPAL

SCHOOL MATHEMATICS PROGRAM SURVEY[a]

COUNTY ______________________

SCHOOL ______________________ DATE ______________

ADMINISTRATION AND ORGANIZATION

1. Pupil Enrollment Data

	Total Number of Students	Pupil Teacher Ratio	Number of Pupils Receiving Remedial Mathematics Services		Number of Students in a Gifted Program in Mathematics	Number of Students Eligible for Free or Reduced Lunches
			Title I	Other Than Title I		
*ECE						
1st grade						
2nd grade						
3rd grade						
4th grade						
5th grade						
6th grade						
7th grade						
8th grade						
TOTAL		▨				

*Early Childhood Education

2. This year are you a:

Teaching Principal ________

Supervising Principal ________

3. In the chart below, indicate the percentage of your time used in the performance of each of the listed duties.

CATEGORIES OF DUTIES	PERCENTAGE OF TIME
Administrative duties (includes office routine, school plant, business, food services and transportation)	
Pupil activity programs (e.g., assemblies)	
Teaching	
Organization, administration and improvement of the mathematics program (includes supervision)	
Organization, administration and improvement of instructional programs excluding mathematics (includes supervision)	
Pupil personnel (includes evaluation, records and reports, counseling, conferences and discipline)	
School/community relations	
Other (specify)	
TOTAL	100%

4. In the chart below, mark all school organization patterns that apply to your school's mathematics program.

ORGANIZATIONAL PATTERNS	GRADE								
	ECE	1	2	3	4	5	6	7	8
Self-Contained Classroom									
Departmentalization									
Split Grades									
Non-Graded									
Graded									
Instructional Teams									
Team Planning									
Common Math Period									
Block Scheduling									
Student Peer Teaching									
Other (specify) ________									

---

[a] Completed by elementary principals

5. In the chart below, mark the dominant grouping dsed in your school for mathematics instruction.

DOMINANT GROUPING	GRADE ECE	1	2	3	4	5	6	7	8
Individualized Instruction									
Small Group (approximately 2-5 students)									
Large Group (approximately 6-15 students)									
Total Class									
Other (specify)									

6. a) Is mathematics taught daily to each student in your school?

YES _____ NO _____

b) In the chart below indicate the average number of minutes a student in your school spends daily in mathematics instruction. Also, check(✓) whether mathematics is taught in the morning and/or afternoon.

	GRADE LEVEL ECE	1	2	3	4	5	6	7	8
Minutes Spent Daily									
Taught in Morning									
Taught in Afternoon									

c) How often is mathematics instruction interrupted by activities such as assemblies, athletic events and so forth?

Frequently _____ Occasionally _____ Seldom _____ Never _____

7. a) Do you have a mathematics specialist on your school staff?

YES _____ NO _____

b) If yes, list the three major functions the specialist performs.

1) ____

2) ____

3) ____

8. a) Do you have a written plan for the improvement of your school's mathematics program?

YES _____ NO _____

b) If yes, indicate the school year when written or last revised. _______

9. a) During this year, have you devoted any staff meetings to the study and review of the mathematics program in your school.

YES _____ NO _____

b) If yes, how many hours? _____

SUPERVISION

10. Within your school, who supervises mathematics instruction?

County Mathematics Coordinator _____
School Mathematics Specialist _____
Principal _____

Guidance Counselor _____
Assistant Principal _____
Other (specify) _____
____

11. a) Indicate the number of tenured and non-tenured teachers of mathematics in your school.

Tenured _____ Non-tenured _____

b) Indicate in the chart below the average number of hours each teacher was observed in mathematics instruction during this school year.

	Average Hours Observed Tenured Teachers	 Non-tenured Teachers
By school-level observer		
By county-level observer		

12. Who has the major responsibility for decisions in the following areas?

a) basic strategies to be used in mathematics instruction

__________________________ (Title)

b) selection of supplementary books and materials

__________________________ (Title)

c) evaluation of the mathematics program

__________________________ (Title)

d) testing program(s) in addition to State-County Testing Program

__________________________ (Title)

e) use of teacher aides or volunteers

__________________________ (Title)

f) mathematics in-service training programs

______________________________ (Title) .

g) amount of time to be used in mathematics instruction

______________________________ (Title)

TESTING PROGRAM

13. a) Are standardized mathematics tests other than those required as a part of the State-County Testing Program administered to the pupils in your school?

YES _____ NO _____

b) If yes, list the grades to which they are given.

____

c) If yes, to what students are they given?

Title I Only _____
All Students _____
Other (specify) _____
____

14. a) Are the results from either the mathematics portion of the State-County Testing Program or other school administered standardized mathematics tests used by the principal and/or teacher?

YES _____ NO _____

b) If yes, list the ways in which the results are most frequently used.

____

____

____

FINANCE

15. This year (1978-79) the total cost per pupil of all instructional materials at your school was ______________ .

16. Indicate in the following chart the cost per pupil of the mathematics instructional materials for each of the last three years.

PURPOSE OF THE EXPENDITURE	COST PER PUPIL OF MATHEMATICS MATERIAL BY YEAR		
	1976-77	1977-78	1978-79
For Basal Program			
For Supplementary Materials for Basal Program			
For other Supplementary Mathematics Materials			

17. This year, the total cost per pupil for all library materials was __________ .

18. This year, the total cost per pupil for library materials related to mathematics was __________ .

SPECIAL PROGRAMS

19. a) Is there a Title IV-C mathematics program serving your school?

YES _____ NO _____

b) If yes, the program's name is ______________________________ .

20. a) If you have a Title I mathematics program, check how time is provided for the program.

- _____ pupil is periodically removed from regular mathematics class
- _____ pupil is scheduled for remedial instruction in addition to regular mathematics class
- _____ other (specify) ______________________________

b) List the title(s) of the person(s) who provide(s) these services.

____

____

____

21. a) If you have a remedial mathematics program other than Title I, indicate how the time is provided for the program.

- _____ pupil is periodically removed from regular mathematics class
- _____ remedial class replaces regular mathematics class
- _____ pupil is scheduled for remedial instruction in addition to regular mathematics class
- _____ other (specify) ______________________________

b) List the title(s) of the person(s) who provide(s) these services.

____

____

____

22. a) If you have special mathematics services in your school for mathematically gifted students, how are they provided?

- _____ pupil is periodically removed from regular mathematics class
- _____ gifted class replaces regular mathematics class
- _____ pupil is scheduled for gifted instruction in addition to regular mathematics class
- _____ other (specify) ______________________________

b) List the title (s) of the person(s) who provide(s) these services.

____

____

____

23. a) Does your school have a special mathematics program for the more capable mathematics students, other than those in a gifted program?

YES _____ NO _____

b) If yes, list the title(s) of the person(s) who provide(s) these services.

____

____

____

INSTRUCTION

24. Is there a mathematics resource center in your building (e.g., special place in library, separate room)?

YES _____ NO _____

25. Is there a list of community resources related to mathematics available?

YES _____ NO _____

26. Are there written guidelines to assist teachers in selecting instructional materials for mathematics?

YES _____ NO _____

27. List the basil textbook(s) used in your school.

PUBLISHER	TITLE	COPYRIGHT DATE	GRADES

28. Which of the following journals or periodicals does your school subscribe to:

Arithmetic Teacher _____
Teacher _____
Learning _____
Instructor _____
School Science and Mathematics _____

29. Do you have guidelines specifically designed for observing the teaching of mathematics?

YES _____ NO _____

PROGRAM STRENGTHS, NEEDS AND RECOMMENDATIONS

30. In your opinion, what are the three greatest strengths of your mathematics program?

1)

2)

3)

31. In your opinion, what are the three greatest needs of your mathematics program?

1)

2)

3)

32. What specific recommendations would you make to improve the mathematics program in West Virginia?

APPENDIX E

Sample Data

OPINIONNAIRE DATA

Item: Basic skills in math should be defined as addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals.

Variable Code: 5.1C, 5.1S, 5.2C, 5.2S

Item #: A33, CE22, GHI22

Comments:

Tch.	Resp.	L.A. L.G.	L.A. H.G.	A.A. L.G.	A.A. H.G.	H.A. L.G.	H.A. H.G.	L.G.	H.G.	Samp.	Grp.	Resp.	Samp.
ELEMENTARY	A	32 48.5	51 45.9	29 43.3	25 40.3	33 44.6	53 44.5	94 45.4	129 44.2	164 41.8	SUPT	A	14 34.1
	B	29 43.9	50 45.0	31 46.3	27 43.5	33 44.6	51 42.9	93 44.9	128 43.8	183 46.7		B	20 48.8
	C	4 6.1	5 4.5	5 7.5	7 11.3	4 5.4	9 7.6	13 6.3	21 7.2	22 5.6		C	0 0
	D	1 1.5	4 3.6	2 3.0	1 1.6	4 5.4	5 4.2	7 3.4	10 3.4	16 4.1		D	4 9.8
	E	0 0	1 0.9	0 0	2 3.2	0 0	1 0.8	0 0	4 1.4	7 1.8		E	3 7.3
MIDDLE	A	7 58.3	17 54.8	13 61.9	9 75.0	9 60.0	10 34.5	29 60.4	36 50.0	162 56.8	SUPERVISOR	A	3 25.0
	B	3 25.0	10 32.3	7 33.3	3 25.0	4 26.7	13 44.8	14 29.2	26 36.1	86 30.2		B	2 16.7
	C	0 0	0 0	0 0	0 0	1 6.7	3 10.3	1 2.1	3 4.2	9 3.2		C	0 0
	D	2 16.7	4 12.9	0 0	0 0	0 0	1 3.4	2 4.2	5 6.9	16 5.6		D	0 0
	E	0 0	0 0	1 4.8	0 0	1 6.7	2 6.9	2 4.2	2 2.8	12 4.2		E	7 58.3
HIGH	A	4 36.4	12 66.7	5 29.4	15 60.0	10 58.8	16 35.6	19 42.2	43 48.9	132 49.4	COLLEGE	A	5 11.6
	B	4 36.4	4 22.2	9 52.9	6 24.0	6 35.3	24 53.3	19 42.2	34 38.6	104 39.0		B	15 34.9
	C	2 18.2	1 5.6	2 11.8	0 0	1 5.9	4 8.9	5 11.1	5 5.7	13 4.9		C	7 16.3
	D	1 9.1	1 5.6	1 5.9	3 12.0	0 0	0 0	2 4.4	4 4.5	13 4.9		D	7 16.3
	E	0 0	0 0	0 0	1 4.0	0 0	1 2.2	0 0	2 2.3	5 1.9		E	9 20.9

Layperson: yes [✓ no]
Item#

APPENDIX F

Characteristics of Successful Mathematics Programs

NOTE: The following factors must be given attention when reviewing this appendix:

(1) The items marked (inst) were included on the MTF survey instruments for the purpose of gathering information and were not developed by the MTF at the initial meeting. The data collected on these items should be reviewed in order to assess their importance.

(2) All other items were developed by the MTF at the initial meeting. It must be remembered that this was prior to data collection; therefore, any review of these items must also include the findings from the data collection.

(3) Some items were developed for reaction purposes and were not necessarily the opinion of the MTF (e.g., 5.2C on p. 132). Again, all findings for each characteristic must be examined when accessing its importance.

CATEGORIES:
1. Administration and Organization
2. Supervision and Leadership
3. Curriculum - Development and Evaluation
4. Curriculum - Content
5. Curriculum - Program
6. Instruction - Materials
7. Instruction - Miscellaneous
8. Instruction - Strategies
9. Instruction - Classroom Environment
10. Professional Development
11. Community
12. State Department of Education
13. College or University

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
1. Administration and Organization	1.1C Class size should be limited in grades 7-12 to 15 for remedial and 25 for other classes. (AO-7)		
	1.2C Funds should be allotted specifically for the math program. (AO-12)	1.1S Funds should be allotted specifically for the math program. (AO-13) (AO-14)	
		1.2S Interruptions of the math program should be avoided. (AO-5)	
		1.3S Junior and senior high school math teachers should have a common planning period. (AO-33)	
		1.4S High school teachers should teach courses of various levels. (AO-6)	
		1.5S Block scheduling, team planning, and instructional teams should be used to allow for greater flexibility in meeting the needs of students. (AO-8)	
		1.6S The math program should be departmentalized above grade 3. (AO-24)	
		1.7S Students should be grouped homogeneously for math. (I-6)	1.1T Students should be grouped homogeneously for math. (I-6)
			1.2T Flexible grouping should be used in self-contained classrooms. (I-7)
			1.3T Teachers should individualize instruction. (I-24)
			1.4T Teachers should utilize peer teaching. (I-12)
		1.8S Planned communication between teachers and counselors should be provided. (AO-26)	

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
	1.3C Permanent records for students should be maintained at the county level. (AO-29)	1.9S A student's record should be used as a means for communicating across grade levels. (AO-29)	
	1.4C The physical facilities should be adaptable to small group work and should facilitate the use of manipulative aids. (AO-16)	1.10S The physical facilities should be adaptable to small group work and should facilitate the use of manipulative aids. (AO-16)	
	1.5C A resource center specifically for math should exist in the county media center. (I-20)	1.11S A resource center specifically for math should exist in the school. (I-20)	
		1.12S Guidelines for evaluating the teaching of math should be utilized. (AO-11)	
		1.13S Teaching/supervising principals (inst)	
		1.14S Principals percentage of time (inst)	
		1.15S Organizational patterns (inst)	
	1.6C Tenured/non/tenured teachers (inst)		
	1.7C Pupil-teacher ratio (inst)	1.16S Pupil-teacher ratio (inst)	
2. Supervision and Leadership	2.1C A math curriculum specialist should be employed at the county level. (AO-17)		
	2.2C A county should make use of teachers in leadership roles related to math. (AO-25)	2.1S A school should make use of teachers in leadership roles related to math. (NI)	
	2.3C Teachers should be rewarded for serving in leadership roles. (AO-23)		

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
		2.2S Department chairpersons should have clear job descriptions. (AO-18)	
	2.4C Math specialist in county (inst)	2.3S Math specialist in school (inst)	
	2.5C Who supervises math? (inst)	2.4S Who supervises math? (inst)	
	2.6C Responsibility for decisions (inst)	2.5S Responsibility for decisions (inst)	
3. Curriculum - Development and Evaluation	3.1C Each system should have a statement of its philosophy and objectives. (C-33)		
	3.2C Each system should have a written description of the process it uses for curriculum development and evaluation. (AO-2)	3.1S A school should have a written description of the process it uses for evaluating its math program. (AO-28)	
	3.3C A county should have a written plan for improving the math program. (NI)	3.2S A school should have a written plan for improving the math program. (AO-30)	
	3.4C Teachers should be involved in curriculum development and evaluation activities at the county level. (AO-2)		
	3.5C Laypersons should be involved in curriculum development and evaluation at the county level. (AO-3)		
	3.6C A county's math program should be continuous across grade levels. (C-12)	3.3S A school math program should be continuous across grade levels. (NI)	
	3.7C Guidelines for selecting math instructional material should be available. (C-24)		

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
	3.8C Supervisors should conduct frequent classroom observations. (AO-10)	3.4S Principals should conduct frequent classroom observations. (AO-10)	
		3.5S Principals should meet with teachers specifically for the purpose of examining the math program. (AO-9)	
		3.6S Competency exam - each grade level (inst)	
		3.7S Competency exam - with remedial program (inst)	
		3.8S Competency exam - for promotion to high school (inst)	
		3.9S SCTP to seniors (inst)	
		3.10S Use tests other than SCTP (inst)	
		3.11S Use SCTP results (inst)	
		3.12S Competency exam - for graduation from high school (inst)	3.1T A teacher's evaluation of student performance should include a variety of assessment techniques. (I-5)
4. Curriculum - Content			4.1T Applications of math should be stressed. (C-3)
			4.2T Math in life skills should be included at all levels. (C-5)
			4.3T Problem solving skills such as patterson finding should be given greater emphasis. (C-20)
			4.4T Teachers should provide experiences concerned with probability and statistics. (C-22)

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
			4.5T Teachers should give more emphasis to decimals. (C-29)
			4.6T Geometry experiences should be included at all grade levels. (C-30)
			4.7T Mastery of computation with fractions should be required for high school graduation. (C-23)
			4.8T Metric (inst)
			4.9T Measurement (inst)
			4.10T Graphing (inst)
			4.11T Applications should not be sex-stereotyped (inst)
5. Curriculum - Program	5.1C Basic skills, defined as. . (NCSM) (C-1)	5.1S Basic skills, defined as... (NSCM) (C-1)	
	5.2C In the elementary school, the only math basic skills are addition, subtration, multiplication, and division. (C-31)	5.2S In the elementary school, the only math basic skills are addition, subtraction, multiplication, and division. (C-31)	
	5.3C The amount of reading in math textbooks should be minimal. (C-26)		
		5.3S The curriculum should be a spiral within and across grade levels. (C-21)	
	5.4C A program for gifted students should be available. (C-13)	5.4S A program for the most capable students should be available. (C-13)	
		5.5S A career education program should be in operation. (C-32)	

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
		5.6S Remedial programs should be available at all levels. (AO-31)	
		5.7S Mini courses should be available at the senior high level. (C-11)	
		5.8S A sufficient number of courses should be available so all students may successfully complete four years of math. (C-18) (see C-17)	
		5.9S A course in computer literacy should be available (required for graduation?) (C-10) (C-25)	
		5.10S Calculus should be offered. (C-19)	
	5.5C A county should encourage and support participation in field days, contests, and so forth. (AO-15)	5.11S A school should encourage and support participation in field days, contests, and so forth. (AO-15)	5.1T Teachers should encourage and support participation in field days, contests, and so forth. (AO-15)
		5.12S Algebra I should be offered in the 8th grade. (inst)	
		5.13S Math courses offered in high school. (inst)	
6. Instruction - Materials	6.1C An inventory of material at the county media center should be available. (AO-27)	6.1S An inventory of math material in the school should be available. (NI)	
		6.2S Curriculum material should be available to the classroom teacher for remediation. (C-4)	
		6.3S Appropriate math material should be available to special education teacher. (C-15)	

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
	6.2C Curriculum materials in the form of multiple textbook adoptions should be available to classroom teachers. (C-6)		
			6.1T Teachers should use a variety of material to supplement the textbook. (C-16)
			6.2T Teachers should use films, filmstrips, and other media. (C-7)
			6.3T Manipulative materials should be used. (C-14)
			6.4T Teachers should use games. (I-10)
			6.5T The hand-held calculator should be used to motivate and reinforce learning. (C-9)
			6.6T Basal text (inst)
			6.7T Chalkboard (inst)
			6.8T Bulletin board (inst)
	6.3C Curriculum materials should present a multicultural, non-sexist approach to the teaching of math. (C-2)		
		6.4S Enrichment materials available to teachers (inst)	
		6.5S Resource materials available to teachers (inst)	
			6.9T Teachers use correct materials for students' age and stage of development. (inst)

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
7. Instruction - Miscellaneous			7.1T A teacher's instructional program should be based on a diagnostic/prescriptive approach. (I-2) 7.2T Teachers should use a variety of methods and materials to meet individual learning styles. (I-3) 7.3T Teachers should make the purpose of each activity clear. (I-16) 7.4T Development (inst) 7.5T Drill should be used in brief and periodic sessions only. (I-11) 7.6T Review (inst) 7.7T Homework (inst) 7.8T A student's progress to a new topic should not depend on complete mastery of the current topic. (I-1)
8. Instruction - Strategies			8.1T Teachers should use mental calculation activities. (I-8) 8.2T Teachers should provide experiences with estimating computations and measurements. (I-9) 8.3T Teachers should give students concrete experiences. (I-19) 8.4T Teachers should emphasize logical reasoning. (I-23) 8.5T Teachers should use activities that require going outside the classroom. (C-27)

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
9. Instruction - Classroom Environment			9.1T Teachers should select activities relevant to individual interests. (I-13) 9.2T Teachers should reinforce the fact that math is as much a subject for females as it is for males. (I-14) 9.3T Teachers should demonstrate that math is an exciting and challenging subject. (I-15) 9.4T Teachers should help students develop a positive self-image. (I-17) 9.5T Teachers should place a minimum amount of stress on students. (I-18) 9.6T Teachers should emphasize the relationship of math to other disciplines. (I-4)
10. Professional Development	10.1C In-service should be available for all elementary and secondary teachers of math. (NI) 10.2C Teachers should be encouraged and supported to attend professional math meetings. (PD-6) 10.3C All new teachers should receive inservice specifically related to the math program. (PD-9) 10.4C Inservice education programs related to "math in the content areas" should be provided. (PD-10)	10.1S Principals should have faculty meetings devoted exclusively to the math program. (AO-9) (see 3.5S)	10.1T Teachers should participate in math inservice education programs. (NI) 10.2T Teachers should be actively involved in math education organizations and participate in their meetings. (PD-7)

TOPIC	COUNTY PROGRAM	SCHOOL PROGRAM	TEACHER
	10.5C Guidelines for selecting cooperating teachers for student teachers should be available. (PD-11)		
		10.2S Teachers should have the opportunity to observe others teaching math. (PD-12)	
		10.3S Teachers should be given a planned opportunity to communicate across grade levels concerning the math program. (PD-14)	
	10.6C Professional math education journals and other publications should be available at the county media center. (NI)	10.4S A school should have professional math education journals. (PD-17)	
			10.3T Teachers should pursue graduate study in math education. (PD-8)
	10.7C The Math Specialist should receive inservice in the following areas . . . (PD-5)		10.4T Teachers should receive inservice in the following areas . . . (PD-5)
		10.5S Percentage of county inservice in math (inst)	
11. Community	11.1C Adult education math programs should be available. (AO-22)		
	11.2C Special programs should be available to communicate the nature of the math program to the public. (AO-20)	11.1S Special programs should be available to communicate the nature of the math program to the public. (AO-20)	
	11.3C Special programs should be available to communicate the importance of math to the public. (AO-21)	11.2S Special programs should be available to communicate the importance of math to the public. (AO-21)	
			11.1T Teachers should use community resources. (AO-19)

TOPIC	STATE DEPARTMENT OF EDUCATION	COLLEGE OR UNIVERSITY
12. State Department of Education	12.1 The West Virginia Board of Education should increase the mathematics requirement for graduation. (C-8)	
	12.2 Practice tests related to the State-County Testing Program should be available to teachers. (C-28)	
	12.3 The West Virginia Board of Education should establish a minimum amount of time to be spent daily in math instruction. (AO-1)	
	12.4 Each Regional Educational Service Agency should employ a math specialist. (AO-32)	
	12.5 The mathematics standards in the *Standards for the Approval of Teacher Education Programs in West Virginia* should be reviewed and revised. (PD-3)	
	12.6 The State Legislature's guidelines for the school calendar should facilitate inservice education. (PD-15)	
	12.7 The Systematic Program for Continuing Education should facilitate inservice education at the local level. (PD-16)	
	12.8 Schools with Title IV-C projects (inst)	
	12.9 Age of enrollment in first grade (inst)	
	12.10 Title I (inst)	
13. College or University		13.1 Preservice teacher training programs should have an arithmetic entrance requirement. (PD-1)
		13.2 Students should have an opportunity to work in classrooms early in their teacher education program. (PD-2)
		13.3 Preservice teachers should have more training in . . . (PD-4)

APPENDIX G

Groups Completing Each Survey Instrument
and
Survey Items Administered for Each Program Characteristic

Groups Completing Each Survey Instrument

Survey Instruments	TEACHERS	PRINCIPALS	SUPERVISORS	SUPERINTENDENTS	COLLEGE PROF.	LAYPERSONS
Opinionnaire •elementary •secondary	X[a]		X	X	X	X
Program Description	X					
Instructional Practices	X					
School Mathematics Program Survey •elementary •middle/junior high •high school		X				
Preservice Questionnaire	X		X		X	
Inservice Questionnaire	X		X		X	
Open-ended Questionnaire	X	X	X	X	X	X
Background Information •elementary •middle/junior high •high school	X					
Superintendents' Survey				X		
College Survey					X[b]	

[a] An X identifies the group(s) that completed an instrument.

[b] Department chairpersons were the only ones given this instrument.

Survey Items Administered for Each Program Characteristic

1.1C	O-DF-23, O-GHI-5
1.2C	E-15, 16; M-14, 15; H-9 10
1.1S	see 1.2C
1.2S	E-6c, M-5b, H-1
1.3S	M-32, H-28
1.4S	O-DF-26, O-GHI-8
1.5S	E-4, M-3
1.6S	O-A-29, O-DF-28, O-GHI-10, E-4, M-3
1.7S	O-A-28, O-DF-29, O-GHI-11
1.1T	see 1.7S
1.2T	O-B-28, H-20
1.3T	O-B-19, O-DF-25, O-GHI-7, E-5, M-4, H-30
1.4T	O-A-40, O-DF-36, O-GHI-18, E-4, M-3
1.8S	O-A-19, O-DF-27, O-GHI-9, M-29, H-25
1.9S	PD-B-45, PD-CE-47
1.3C	see 1.9S
1.4C	PD-B-51, PD-B-54, PD-DF-44, PD-CE-55
1.10S	see 1.4C
1.11S	O-B-31, O-CE-35, O-GHI-36, E-24, M-24, H-19
1.5C	see 1.11S
1.12S	none
1.13S	E-2, 3; M-2
1.14S	see 1.13S
1.15S	E-5, M-4, H-30
1.6C	E-11a, M-9, H-5a
1.7C	E-1, M-1
1.16S	see 1.7C
2.1C	O-B-34, O-DF-37, O-GHI-44, S-58
2.2C	O-B-20, O-CE-37, O-GHI-37
2.1S	see 2.2C
2.3C	O-A-20, O-GHI-50
2.2S	O-CE-39, 42; O-GHI-39, 42; M-31b, 31c; H-27b
2.4C	E-7a, S-58
2.3S	see 2.4C
2.5C	E-10, M-8, H-4
2.4S	see 2.5C
2.6C	E-12, M-11
2.5S	see 2.6c
3.1C	S-51
3.2C	O-B-21; O-CE-28; O-GHI-28; E-8; M-6; H-2; S-52, 54
3.1S	see 3.2C
3.2S	O-B-21, O-CE-28, O-GHI-28, E-8, M-6, H-2, S-52
3.3C	see 3.2S
3.4C	O-B-40, PD-B-48, PD-CE-56
3.5C	O-B-36, O-DF-31, O-GHI-3, S-55
3.3S	PD-A-47, PD-DF-52
3.6C	see 3.3S
3.7C	E-26, M-26, H-21
3.8C	O-B-26; O-DF-21; O-GHI-3; E-11b, 29; M-10, 28; H-5b, 23
3.4S	see 3.8C
3.5S	E-9; M-7, 30; H-3, 26
3.6S	O-A-24
3.7S	O-B-25, O-CE-41, O-GHI-41
3.8S	O-C-21
3.9S	O-CE-20, O-GHI-20
3.10S	E-13, M-12, H-7
3.11S	E-14, M-13, H-8
3.1T	O-B-30, O-DF-38, O-GHI-45, PD-A-52, PD-DF-48
3.12S	O-E-21, O-GHI-21
4.1T	IP-AB-61, 62, 63, 75; IP-CDEF-64, 65, 66, 78; O-B-22, 24; O-DF-30, 33; O-CE-30; O-GHI-12, 15, 30
4.2T	see 4.1T
4.3T	see 4.1T
4.4T	see 4.1T
4.5T	O-A-37, O-CEGHI-34
4.6T	O-A-38, O-DF-24, O-GHI-16
4.7T	O-DF-42, O-GHI-49
4.8T	O-A-25, O-CEGHI-33
4.9T	O-A-35; O-B-37; O-CE-23; O-DF-35; O-GHI-23, 17
4.10T	see 4.9T
4.11T	PD-B-47, PD-DF-49
5.1C	O-A-33, O-CE-22, O-GHI-22
5.1S	see 5.1C
5.2C	see 5.1C
5.2S	see 5.1C
5.3C	O-B-23, O-DF-40, O-GHI-47, L-33
5.3S	O-A-32
5.4C	PD-B-46; PD-DF-45; E-1, 22a, 23a; M-1, 21a, 22a; H-16, 17
5.4S	see 5.4C
5.5S	IP-AB-64, IP-CDEF-67
5.6S	O-B-32; O-CE-35; E-1. 20, M-1, 20; H-14, 15; L-14
5.7S	O-CEGHI-27, L-7
5.8S	O-DF-20; O-GHI-2, 48; O-DF-41; L-21, 54; S-57
5.9S	O-CE-30, 40; O-GHI-30; IP-AB-75; IP-CDEF-78, L-19
5.10S	O-DF-39, O-GHI-46
5.5C	PD-B-50, PD-CE-49
5.11S	see 5.5C
5.1T	see 5.5C
5.12S	O-CE-38, O-GHI-38, M-23, L-18
5.13S	none
6.1C	PD-A-53, PD-DF-46
6.1S	see 6.1C
6.2S	PD-B-42, PD-DF-54
6.3S	PD-A-43, PD-CE-57
6.2C	none
6.1T	IP-AB-65, IP-CDEF-68; PD-AB-66, 67; PD-CDEF-69, 70
6.2T	PD-B-49; PD-DF-56; IP-AB-71, 72, 73, 74, 75; IP-CDFF-74, 76, 77
6.3T	IP-AB-60, IP-CDEF-63

6.4T	IP-AB-55, IP-CDEF-58
6.5T	O-B-39, O-CEGHI-43, IP-AB-56, IP-CDEF-59
6.6T	IP-AB-79, IP-CDEF-82, E-27
6.7T	IP-AB-80, 81; IP-CDEF-83
6.8T	see 6.7T
6.3C	none
6.4S	PD-A-48, PD-CE-51
6.5S	H-18
6.9T	PD-B-41, PD-DF-55
7.1T	O-A-30; O-DF-19, O-GHI-1; PD-A-45, 54; PD-CE-48; PD-DF-50
7.2T	see 7.1T
7.3T	none
7.4T	none
7.5T	IP-AB-76; IP-AD-77; IP-CDEF-79, 80
7.6T	see 7.5T
7.7T	see 7.5T
7.8T	O-A-21, O-CE-31, O-GHI-31
8.1T	IP-AB-57, IP-CDEF-60
8.2T	IP-AB-58, 59; IP-CDEF-61, 62
8.3T	none
8.4T	none
8.5T	IP-AB-68, IP-CDEF-71
9.1T	PD-B-52, PD-CE-45
9.2T	none
9.3T	PD-A-51, PD-DF-51
9.4T	PD-A-46, PD-DF-47
9.5T	PD-B-53, PD-CE-50
9.6T	O-A-22, O-CE-29, O-GHI-29, PD-A-50, PD-CE-52
10.1C	none
10.1S	see 10.1C
10.1T	see 10.1T
10.2C	PD-B-44, PD-CD-53, O-A-34
10.2T	see 10.2C
10.3C	S-53c
10.4C	O-A-39
10.5C	none
10.2S	O-B-38, PD-A-44, PD-CE-54
10.3S	PD-B-43, PD-CE-44
10.6C	PD-A-49, PD-DF-57, E-28, M-27, H-22
10.4S	see 10.6C
10.3T	PD-A-42, PD-DF-54
10.7C	none
10.4T	IN-ADFHI
10.5S	S-53
11.1C	O-B-33, O-CE-19, O-GHI-19
11.2C	O-B-27, O-DF-34, O-GHI-16
11.1S	see 11.2C
11.3C	O-A-23, O-CE-24, O-GHI-24
11.2S	see 11.3C
11.1T	IP-AB-69, 70; IP-CDEF-72, 73; E-25; M-20,25; H-20
12.1	O-CEGHI-32, H-24, S-57
12.2	O-A-27, O-DF-22, O-GHI-4
12.3	O-B-35, O-DF-32, O-GHI-14, E-6, M-5, S-56
12.4	O-A-31, O-CEGHI-25
12.5	CC
12.6	none
12.7	none
12.8	none
12.9	none
12.10	none
13.1	O-A-36, O-CE-26, O-GHI-16
13.2	O-A-26
13.3	PS-BCEHI

Key:

O - Opinionnaire
PD - Program Description
IP - Instructional Practices
PS - Preservice
IN - Inservice

Example: O-DF-23 - item #23 of the Opinionnaire on Forms D and F

E - Elementary School Mathematics Program Survey
M - Middle/Junior High School Mathematics Program Survey
H - High School Mathematics Program Survey
S - Superintendents' Survey
CC - College Chairpersons' Survey
L - Laypublic Survey

Example: E-15 - Item #15 on the Elementary School Mathematics Program Survey

APPENDIX H

Selection of
Teacher and Principal Respondents
by Achievement Areas

Procedures Used to Select
Teacher and Principal Respondents

Schools were used as the sampling unit for the selection of both teacher and principal resondents. Two samples of schools were used in the study. One sample was designed to depict the resonses of "typical" teachers and principals. The other sample was designed to relate the responses of teachers and principals to the mathematics achievement of students.

The first, or descriptive, sample was composed of a census of middle, junior high, and high schools and a random sample of 100 elementary schools. The second, achievement related, sample used returns from a subgroup of the schools mentioned above and an additional set of elementary schools was selected. Responses from teachers and principals in the selected schools were analyzed using the following sets of State-County Testing Program scores: (1) 1975-76 grade 3 and 1978-79 grade 6; (2) 1975-76 grade 6 and 1978-79 grade 9; and (3) 1976-77 grade 9 and 1978-79 grade 11. Based on these test scores, each school was categorized on two variables. The variables were mean total mathematics achievement for the school at the beginning of each period listed above and the difference between the actual and the "expected" achievement scores at the end of each period. The steps used in assigning schools to the achievement areas were as follows:

1. Students were identified who had participated in State-County Testing Program in 1978-79 and had also participated in the SCTP in the same county at the next lower level of the SCTP. For example, 11th grade students in a given county who had participated in the SCTP in 1978-79 and who had also participated in the SCTP as 9th graders in the same county in 1976-77 were selected.

2. The mean total mathematics score for 1978-79 (i.e., posttest) for the students identified in in step 1 was computed for each school. The mean total mathematics scores for the same groups of students on their last testing prior to 1978-79 (i.e., pretest) were computed. For middle schools the mean pretest scores were based on the school the students attended in 1975-76.

3. For each pair of grades a regression equation relating the 1978-79 mean total mathematics posttest scores to the mean total mathematics pretest scores computed in step 2 was computed. This regression equation was of the form: $Y = a + bX$. Y was the expected posttest score, a the "y intercept", b the beta value representing the relative weight given the pretest score, and x the pretest score.

4. The difference between the 1978-79 mean total mathematics posttest score for a school and its expected score, determined by substituting the mean total mathematics pretest score into the equation above, was computed. Schools whose mean total mathematics posttest scores showed the greatest positive difference from their expected scores were classified as "high-gain" schools, and those whose mean total mathematics posttest scores showed the greatest negative difference from their expected scores were classified as "low-gain" schools. The "gain" score was designed to estimate the effect of a school on mathematics achievement.

The mean third grade mathematics achievement scores of students attending all elementary schools in the State having sixth grades were used to categorize each of these schools as "low-achieving," "average-achieving", or "high-achieving." Schools having a mean third grade total mathematics expanded scale score of less than 348.6 were categorized as low-achieving, schools between 348.6 and 366.3 as average achieving schools, and schools over 366.3 as high-achieving.

The mean sixth grade mathematics achievement scores of students attending all middle or junior high schools in the state were used to categorize each of these schools as low-achieving, average-achieving, or high-achieving. Schools having a mean sixth grade total mathematics expanded scale score of less than 458.0 were categorized as low-achieving, schools between 458.0 and 477.4 as average-achieving schools, and schools over 477.4 as high-achieving.

The mean ninth grade mathematics achievement scores of students attending all high schools in the state were used to categorize each of these schools as low-achieving, average-achieving, or high-achieving. Schools whose students have a mean ninth grade total mathematics expanded scale score of less than 533.1 were categorized as low-achieving, schools between 533.1 and 551.4 as average-achieving, and schools over 551.4 as high-achieving.

The classifications by achievement and by "gain" were combined to form the following six areas:

1. low-achievement/low-gain
2. low-achievemnt/high-gain
3. average-achievement/low-gain
4. average-achievemnt/high-gain
5. high-achievement/low-gain
6. high-achievement/high-gain

In addition to these six, the areas of "high-gain" and "low-gain" were used in the analyses.

Number of Teachers and Principals
Surveyed by Achievement Area

	Elementary Teachers	Elementary Principals	Middle/JHS Teachers	Middle/JHS Principals	Senior High Teachers	Senior High Principals
low-achievement/ low-gain	80	10	20	8	32	12
low-achievement/ high-gain	186	19	52	15	47	17
average-achievement/ low-gain	118	14	51	16	50	17
average-achievement/ high-gain	158	10	24	7	41	8
high-achievement/ low-gain	119	15	24	8	36	10
high-achievement/ high-gain	193	15	59	16	77	16
low-gain	317	39	95	32	119	39
high-gain	537	44	135	38	165	41

APPENDIX I

Sample Survey Summary Form
and
Sample Findings-Assessed Need Form

Sample Survey Summary Form

OPINIONNAIRE DATA

Item: Basic skills in math should be defined as addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals.

Variable Code: 5.1C, 5.1S, 5.2C, 5.2S

Item #: A33, CE22, GH122

Comments:

Tch.	Resp.	L.A. L.G.	L.A. H.G.	A.A. L.G.	A.A. H.G.	H.A. L.G.	H.A. H.G.	L.G.	H.G.	Samp.	Grp.	Resp.	Samp.
ELEMENTARY	A	32 48.5	51 45.9	29 43.3	25 40.3	33 44.6	53 44.5	94 45.4	129 44.2	164 41.8	SUPT	A	14 34.1
	B	29 43.9	50 45.0	[illegible]1 [illegible]6.3	27 43.5	33 44.6	51 42.9	93 44.9	128 43.8	183 46.7		B	20 48.8
	C	4 6.1	5 4.5	5 7.5	7 11.3	4 5.4	9 7.6	13 6.3	21 7.2	22 5.6		C	0 0
	D	1 1.5	4 3.6	2 3.0	1 1.6	4 5.4	5 4.2	7 3.4	10 3.4	16 4.[illegible]		D	4 9.8
	E	0 0	1 0.9	0 0	2 3.2	0 0	1 0.8	0 0	4 1.4	7 1.8		E	3 7.3
MIDDLE	A	7 58.3	17 54.8	13 61.9	9 75.0	9 60.0	10 34.5	29 60.4	36 50.0	162 56.8	SUPERVISOR	A	3 25.0
	B	3 25.0	10 32.3	7 33.3	3 25.0	4 26.7	13 44.8	14 29.2	26 36.1	86 30.2		B	2 16.7
	C	0 0	0 0	0 0	0 0	1 6.7	3 10.3	1 2.1	3 4.2	9 3.2		C	0 0
	D	2 16.7	4 12.9	0 0	0 0	0 0	1 3.4	2 4.2	5 6.9	16 5.6		D	0 0
	E	0 0	0 0	1 4.8	0 0	1 6.7	2 6.9	2 4.2	2 2.8	12 4.2		E	7 58.3
HIGH	A	4 36.4	12 66.7	5 29.4	15 60.0	10 58.8	16 35.6	19 42.2	43 48.9	132 49.4	COLLEGE	A	5 11.6
	B	4 36.4	4 22.2	9 52.9	6 24.0	6 35.3	24 53.3	19 42.2	34 38.6	104 39.0		B	15 34.9
	C	2 18.2	1 5.6	2 11.8	0 0	1 5.9	4 8.9	5 11.1	5 5.7	13 4.9		C	7 16.3
	D	1 9.1	1 5.6	1 5.9	3 12.0	0 0	0 0	2 4.4	4 4.5	13 4.9		D	7 16.3
	E	0 0	0 0	0 0	1 4.0	0 0	1 2.2	0 0	2 2.3	5 1.9		E	9 20.9

Layperson: yes [✓ no]
Item#_____

Sample Findings Assessed Need Form

CATEGORY: Curriculum - Program

CHARACTERISTIC: 5.1C Basic skills, defined as. . . (NCSM) (C-1)

DATA SOURCES: 0-A-33, 0-CE-22, 0-GHI-22, OTHER, MTF, LITT

FINDINGS	DISCREPANCIES	NEED AREA
1. MTF Survey Opinionnaire Teachers-87% agree with limited definition Supt. -84% agree with limited definition Superv. -42% agree/58% disagree with limited definition College -46% agree/37% disagree with limited definition 2. Other 2.1 NCSM position paper on expanded definition 2.2 NCTM, ASSM, WVCTM endorsement of expanded definition 3. MTF Opinion (expanded definition) 4. Literature "Back-to-basics" mathematics instruction of the 1980's is not enough to assure that students will develop satisfacty mathematical problem solving abilities. Wilson, J. An interpretation of NAEP findings. Included in Education Daily, 12 (178), Friday, September 14, 1979, p.1.	MTF survey findings on Opinionnaire for teachers and superintendents versus position of NCSM, NCTM, ASSM, WVCTM, and Literature	Basic Skills

APPENDIX J

Program Characteristics Classified by Need Areas

Key:

AE - adolescent education

AD - affective domain

BS - basic skills in mathematics

CE - continuing education

CD - curriculum development & evaluation

IM - instructional materials

IP - instructional practices

IT - instructional time

ON - organizational network

OI - organizing for instruction

PR - priority

HA - programs for high-ability students

RP - remediation programs

MT - mathematics teachers

TE - teacher education

LP - low priority

IN - inconclusive data

CN - conflicting data

1.1C	OI	2.1C	ON	3.1C	CD	4.1T, 4.2T, 4.3T, 4.4T	BS
1.2C, 1.1S	LP	2.2C, 2.1S	ON	3.2C, 3.1S	LP	4.5T	CN
1.2S	LP	2.3C	ON	3.3C, 3.2S	CD	4.6T	BS
1.3S	LP	2.2S	ON	3.4C	CN	4.7T	CN
1.4S	IN	2.4C, 2.3S	ON	3.5C	ON	4.8T	BS
1.5S	IN	2.5C, 2.4S	ON	3.6C, 3.3S	LP	4.9T, 4.10T	BS
1.6S	CN	2.6C, 2.5S	ON	3.7C	IM	4.11T	IN
1.7S, 1.1T	OI			3.8C, 3.4S	CD		
1.2T	OI			3.5S	CD		
1.3T	OI			3.6S	IN		
1.4T	LP			3.7S	RP		
1.8S	CD			3.8S	IN		
1.3C, 1.9S	IN			3.9S	IN		
1.4C, 1.10S	OI			3.10S	CD		
1.5C, 1.11S	IM			3.11S	CD		
1.12S	LP			3.1T	LP		
1.13S, 1.14S	ON			3.12S	CN		
1.15S	OI						
1.6C	IN						
1.7C, 1.16S	OI						

5.1C, 5.1S	
5.2C, 5.2S	BS
5.3C	IN
5.3S	LP
5.4C, 5.4S	HA
5.5S	IN
5.6S	RP
5.7S	LP
5.8S	AE
5.9S	BS
5.10S	CN
5.5C, 5.11S, 5.1T	IP
5.12S	HA
5.13S	LP

6.1C, 6.1S	IM
6.2S	RP
6.3S	LP
6.2C	LP
6.1T	LP
6.2T	LP
6.3T	IP
6.4T	IP
6.5T	BS
6.6T	IM
6.7T, 6.8T	LP
6.3C	IM
6.4S	HA
6.5S	IM
6.9T	IM

7.1T, 7.2T	IP
7.3T	LP
7.4T	LP
7.5T, 7.6T	
7.7T	IP
7.8T	CN

8.1T	IP
8.2T	BS
8.3T	IP
8.4T	LP
8.5T	LP

9.1T	IP
9.2T	AE
9.3T	LP
9.4T	AD
9.5T	AD
9.6T	TE

10.1C, 10.1T	CE
10.1S	CD
10.2C, 10.2T	CE
10.3C	CE
10.4C	TE
10.5C	LP
10.2S	CE
10.3S	LP
10.6C, 10.4S	CE
10.3T	CE
10.7C	LP
10.4T	CE
10.5S	CE

11.1C	LP
11.2C, 11.1S	PR
11.3C, 11.2S	PR
11.1T	LP

12.1	AE
12.2	LP
12.3	IT
12.4	CN
12.5	TE
12.6	CE
12.7	CE
12.8	PR
12.9	IN
12.10	PR

13.1	TE
13.2	TE
13.3	TE